



Aerospace Medicine
and Biology
A Continuing
Bibliography
with Indexes

NASA SP-7011(291)
December 1986

(NASA SP-7011(291)) AEROSPACE MEDICINE AND BIOLOGY
A CONTINUING BIBLIOGRAPHY WITH INDEXES
ISSUED BY NASA SP-7011(291) (NATIONAL
AERONAUTICS AND SPACE ADMINISTRATION) 1986 10 10124
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ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series) N86-29762 — N86-31524

IAA (A-10000 Series) A86-43459 — A86-47158

AEROSPACE MEDICINE AND BIOLOGY

**A CONTINUING BIBLIOGRAPHY
WITH INDEXES**

(Supplement 291)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in November 1986 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



Scientific and Technical Information Branch
National Aeronautics and Space Administration
Washington, DC

1986

This supplement is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161, price code A04.

INTRODUCTION

This Supplement to *Aerospace Medicine and Biology* lists 131 reports, articles and other documents announced during November 1986 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of the bibliography was published in July 1964.

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which man is subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects of biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. In general, emphasis is placed on applied research, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the bibliography consists of a bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations, and abstracts when available, are reproduced exactly as they appeared originally in *IAA* or *STAR*, including the original accession numbers from the respective announcement journals. The *IAA* items will precede the *STAR* items within each category.

Seven indexes — subject, personal author, corporate source, foreign technology, contract, report number, and accession number — are included.

An annual index will be prepared at the end of the calendar year covering all documents listed in the 1986 Supplements.

TABLE OF CONTENTS

	Page
Category 51 Life Sciences (General) Includes genetics.	391
Category 52 Aerospace Medicine Includes physiological factors; biological effects of radiation; and weightlessness.	394
Category 53 Behavioral Sciences Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.	403
Category 54 Man/System Technology and Life Support Includes human engineering; biotechnology; and space suits and protective clothing.	405
Category 55 Planetary Biology Includes exobiology; and extraterrestrial life.	410
Subject Index	A-1
Personal Author Index	B-1
Corporate Source Index	C-1
Foreign Technology Index	D-1
Contract Number Index	E-1
Report Number Index	F-1
Accession Number Index	G-1

TYPICAL REPORT CITATION AND ABSTRACT

NASA SPONSORED

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ON MICROFICHE

ACCESSION NUMBER → **N86-11830*** # Massachusetts Inst. of Tech., Cambridge. Dept. of Applied Biological Science. ← **CORPORATE SOURCE**

TITLE → **UTILIZATION OF NON-CONVENTIONAL SYSTEMS FOR CONVERSION OF BIOMASS TO FOOD COMPONENTS: POTENTIAL FOR UTILIZATION OF ALGAE IN ENGINEERED FOODS Annual Report** ← **PUBLICATION DATE**

AUTHORS → **M. KAREL, A. R. KAMAREI, and Z. NAKHOST** Mar. 1985 37 p refs

REPORT NUMBERS → (Contract NCC2-231) (NASA-CR-176257; NAS 1.26:176257) Avail: NTIS HC A03/MF A01 CSCL 06C ← **AVAILABILITY SOURCE**

COSATI CODE → The major nutritional components of the green algae (*Scenedesmus obliquus*) grown in a Constant Cell density Apparatus were determined. Suitable methodology to prepare proteins from which three major undesirable components of these cells (i.e., cell walls, nucleic acids, and pigments) were either removed or substantially reduced was developed. Results showed that processing of green algae to protein isolate enhances its potential nutritional and organoleptic acceptability as a diet component in a Controlled Ecological Life Support System. ← **PRICE CODE**

Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

NASA SPONSORED

↓

ACCESSION NUMBER → **A86-12001*** National Biomedical Research Foundation, Washington, D. C. ← **TITLE**

AUTHORS → **D. G. GEORGE, L. T. HUNT, L.-S. L. YEH, and W. C. BARKER** (National Biomedical Research Foundation, Washington, DC) ← **AUTHOR'S AFFILIATION**

TITLE OF PERIODICAL → **NEW PERSPECTIVES ON BACTERIAL FERREDOXIN EVOLUTION**

PUBLICATION DATE → **Journal of Molecular Evolution** (ISSN 0022-2844), vol. 22, no. 1, 1985, p. 20-31. refs ← **CONTRACT NUMBERS**

(Contract NASW-3954; NIH-GM-08710; NIH-RR-01821)

Ferredoxins are low-molecular-weight, nonheme, iron proteins which function as electron carriers in a wide variety of electron transport chains. Howard et al. (1983) have suggested that the amino end of *Azotobacter vinelandii* ferredoxin shows a greater similarity to the carboxyl end of ferredoxin from *Chromatium vinosum* and that their half-chain sequences are homologous when the half-chains of either species are considered in inverse order. Examination of this proposition has made it necessary to reevaluate previous conclusions concerning the evolution of bacterial ferredoxin. Attention is given to the properties of the bacterial ferredoxin sequences, and the evolution of the bacterial ferredoxins.

G.R.

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 291)

DECEMBER 1986

51

LIFE SCIENCES (GENERAL)

Includes genetics.

A86-43540# ALTERATION OF RAT BRAIN CATECHOLAMINE LEVELS UNDER HYPOXIA

I. SAKURAI and A. NAKAMURA Japan Air Self Defence Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 26, Dec. 1985, p. 181-186. In Japanese, with abstract in English. refs

An investigation was conducted to ascertain the effects that hypobaric and hypoxic hypoxia have on catecholamine (CA) synthesis in the brain of a rat. Male Wistar rats were exposed to either a simulated altitude of 18,000 ft (corresponding to 10.5 percent O₂) for a time period approaching 72 hrs or to hypoxic gas mixtures (10, 7 and 6 percent O₂) for a period of 2 hrs. Norepinephrine (NE) concentration decreased initially and then stabilized at the control level despite continued hypoxic conditions at 18,000 ft. Dopamine (DA) levels significantly increased upon 6 hrs of hypoxic exposure and ultimately stabilized at the control level. The increment at which DA decreased upon 2 hrs of hypoxic exposure was parallel to the severity of the hypoxia. The NE concentration decreased linearly with the concentration of oxygen present during exposure. K.K.

A86-43676 DIGESTIVE SYSTEM RHYTHMS AND THE BODY'S BIOLOGICAL CLOCK [RITMY PISHCHEVARITEL'NOI SISTEMY I BIOLOGICHESKIE 'CHASY' ORGANIZMA]

N. N. LEBEDEV (Nauchno-Issledovatel'skii Institut Obshchei Patologii i Patologicheskoi Fiziologii, Moscow, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 72, April 1986, p. 466-475. In Russian. refs

A86-43677 THE ROLE OF GRAVITY IN PRODUCING DIGESTIVE SYSTEM CHANGES [O ROLI GRAVITATSIONNOGO FAKTORA V FORMIROVANII IZMENENII PISHCHEVARITEL'NOI SISTEMY]

K. V. SMIRNOV Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 72, April 1986, p. 484-489. In Russian. refs

The effect of sustained weightlessness on the activities of gastrointestinal proteases, carbohydrases, and lipases was investigated in rats flown aboard the Cosmos 782, 936, and 1129 biosatellites. Homogenized gastric mucosa and pancreas and homogenized and intact mucosa of small intestine were analyzed 5-6 h after landing. Compared with the ground-based controls, rats exposed to weightlessness exhibited activation of proteolytic enzymes and pancreatic lipase and suppression of amylase activity. The activity of intestinal lipase was redistributed: a decrease in the proximal segment was accompanied with a significant increase in the distal end. The morphological examination of gastric mucosa revealed signs of hypersecretion syndrome. The use of artificial gravity during flights had a normalizing effect on proteolytic enzymes but suppressed the activity of pancreatic amylase even more and had no effect on lipolytic activities. Twenty-five days

after the landing, enzyme activities were close to control levels.

I.S.

A86-44195 SOLUTE CONDUCTANCE OF BLOOD-GAS BARRIER IN HAMSTERS EXPOSED TO HYPEROXIA

D. WANGENSTEEN, R. PIPER, J. A. JOHNSON, A. A. SINHA, and D. NIEWOEHNER (Minnesota, University; USVA, Medical Center, Minneapolis) Journal of Applied Physiology (ISSN 0161-7567), vol. 60, June 1986, p. 1908-1916. refs

A86-44196* Marquette Univ., Milwaukee, Wis. MODELS OF DISUSE - A COMPARISON OF HINDLIMB SUSPENSION AND IMMOBILIZATION

R. H. FITTS, J. M. METZGER, D. A. RILEY, and B. R. UNSWORTH (Marquette University; Wisconsin, University, Milwaukee) Journal of Applied Physiology (ISSN 0161-7567), vol. 60, June 1986, p. 1946-1953. refs

(Contract NAG2-212; NCC2-266)

The effects of 1 and 2 weeks of hindlimb suspension (HS) on the contractile properties of fast- and slow-twitch skeletal muscles of male Sprague Dawley rats are studied and compared with hindlimb immobilization (HI) data. The optimal length and contractile properties of the slow-twitch soleus, fast-twitch extensor digitorum longus, and the vastus lateralis are measured. It is observed that HS and HI affect slow-twitch muscles; isometric twitch duration in the slow-twitch soleus is decreased. Soleus muscle mass and peak tetanic tension declines with disuse. A major difference in the influence of HS and HI on the maximal speed of soleus muscle shortening, V(max) is detected; HS produced a twofold increase in V(max) compared to control data and HI had no significant effect on V(max). The relation between V(max) and myosin concentration is analyzed. The data reveal that HS modifies slow-twitch muscle yielding hybrid fibers with elevated shortening velocities and this change may be dependent on the elimination of load-bearing contractions. I.F.

A86-44197 HOW WELL MIXED IS INERT GAS IN TISSUES?

L. D. HOMER and P. K. WEATHERSBY (U.S. Navy, Naval Medical Research Institute, Bethesda, MD) Journal of Applied Physiology (ISSN 0161-7567), vol. 60, June 1986, p. 2079-2088. Navy-supported research. refs

Potential mechanisms which cause multiexponential curves for washout of inert gas from tissues are examined. Computer simulations of the random walk of gas molecules across a capillary bed are conducted and the data reveal that heterogeneity in adjacent capillaries does not cause significant relative dispersion to produce the curves. The effect of variable flow and transit time on the relative dispersion are studied. The countercurrent exchange and isotropic diffusion are analyzed. It is observed that variations in spacing and countercurrent exchange between capillaries do not produce the multiexponential character of tissue washout curves. Simple diffusion calculations are utilized to display that gas molecules can wander up to several millimeters away from their entry point during an average transit through a tissue bed. It is noted that gas molecules enter and exit tissues from vessels larger than 20 microns in diameter rather than capillaries. A hypothesis that the multiexponential character of skeletal muscle tissue inert gas washout curves are due to either heterogeneity

between tissue regions separated by 3 mm or more, or to countercurrent exchange in vessels larger than 2 microns in diameter is proposed. I.F.

A86-44295

THE PHOTOBIOLOGICAL ASPECTS OF RADIATION DAMAGE IN CELLS [FOTOBIOLOGICHESKIE ASPEKTY RADIATSIONNOGO PORAZHENIIA KLETOK]

M. N. MIASNIK, V. G. SKVORTSOV, and V. A. SOKOLOV Moscow, Energoatomizdat, 1985, 152 p. In Russian. refs

The cellular and molecular mechanisms of radiation damage caused in microorganisms by ionizing radiation and UV light are described, together with the mechanisms of photoreactivation by visible light. The role of DNA-located pyridine dimers in such radiobiological phenomena as the oxygen effect, radioprotective effects, and the relative biological effectiveness of ionizing radiation is considered. Special attention is given to photorecoverable damages connected with Cerenkov radiation. A biophysical model is presented for bacterial cells reacting to radiation by gamma rays. I.S.

A86-45251* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CONTINUOUS BLOOD DENSITOMETRY - FLUID SHIFTS AFTER GRADED HEMORRHAGE IN ANIMALS

H. HINGHOFFER-SZALKAY (NASA, Ames Research Center, Moffett Field, CA; Graz, Universitaet, Austria) American Journal of Physiology: Heart and Circulatory Physiology (ISSN 0363-6135), vol. 19, 1986, p. H342-H350. refs
(Contract FFWF PROJECT 3470)

Rapid fluid shifts in four pigs and two dogs subjected to graded hemorrhage are investigated. Arterial blood density (BD), mean arterial pressure (MAP), central venous pressure (CVP), arterial plasma density (PD), hematocrit (Hct) and erythrocyte density were measured. The apparatus and mechanical oscillator technique for measuring density are described. Fluid shifts between red blood cells and blood plasma and alterations in the whole-body-to-large vessel Hct, F(cell) are studied using two models. The bases of the model calculations are discussed. A decrease in MAP, CVP, and BP is detected at the beginning of hemorrhaging; continued bleeding results in further BD decrease correlating with volume displacement. The data reveal that at 15 ml/kg blood loss the mean PD and BD dropped by 0.99 ± 0.15 and 2.42 ± 0.26 g/liter, respectively, and the Hct dropped by 2.40 ± 0.47 units. The data reveal that inward-shifted fluid has a higher density than normal ultrafiltrate and/or there is a rise in the F(cell) ratio. It is noted that rapid fluid replacement ranged from 5.8 ± 0.8 to 10.6 ± 2.0 percent of the initial plasma volume. I.F.

A86-45318

THE EFFECTS OF CEREBRAL HYPOXIA AND HYPERVENTILATORY HYPOCAPNIA ON THE EPILEPTIFORM ACTIVITY IN THE CEREBRAL CORTEX OF CATS [DEISTVIE TSEREBRAL'NOI GIPOKSII I GIPERVENTILIATSIONNOI GIPOKAPNII NA EPILEPTIFORMNIU AKTIVNOST' KORY BOL'SHIKH POLUSHARII KOSHKI]

S. I. FRANKSHEIN, L. N. SMOLIN, and L. N. SERGEEVA (Institut Obshchei Patologii i Patologicheskoi Fiziologii, Moscow, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 72, May 1986, p. 576-579. In Russian. refs

A86-45319

THE SUPPRESSIVE EFFECT OF CARBON DIOXIDE ON THE ACTIVATION OF COLD RECEPTORS IN THE NASAL CAVITY OF CATS [PODAVLIAUSHCHEE VLIANIE DVOUKISI UGLERODA NA VOZBUZHDENIE KHOLODOVYKH RETSEPTOROV POLOSTI NOSA KOSHKI]

V. D. GLEBOVSKII and A. V. BAEV (Pediatricheskii Meditsinskii Institut, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 72, May 1986, p. 595-602. In Russian. refs

The effect of carbon dioxide concentration in the air passing through the nasal cavity on the afferent fiber impulse activity were studied in decerebrated cats. Passage of air through the nasal

cavity in the direction from the nostrils to the choanes effected strong activation of cold receptors in the nasal cavity walls. When air was drawn in the opposite direction (i.e., 'exhaled'), the receptors' activity decreases. When a 1, 3, or 6-percent CO₂-air mixture was blown through the nasal cavity, the cold receptor activity became depressed in direct proportion to the CO₂ concentration. Thus, like the receptors in the process that regulates lung distension, the cold thermoreceptors in the nasal cavity possess characteristics of chemoreceptors. I.S.

A86-45320

CORRELATIONS BETWEEN THE LEVELS OF CEREBRAL BLOOD FLOW AND CEREBROVASCULAR REACTIVITY AND THE FUNCTIONAL STATE OF BRAIN TISSUE [O VZAIMOSVIAZI UROVNIA KROVOTOKA I REAKTIVNOSTI MOZGOVYKH SOSUDOV S FUNKTSIONAL'NYM SOSTOIANIEM TKANI MOZGA]

B. V. GAIDAR, V. N. SEMERNIA, and G. B. VAINSHEIN (AN SSSR, Institut Evoliutsionnoi Fiziologii i Biokhimii; Voenno-Meditsinskaiia Akademiiia, Leningrad, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 72, May 1986, p. 603-611. In Russian. refs

Changes in the cerebral blood flow and reactivity of brain vessels to CO₂, taking place during the process of brain restoration, were studied in rabbits with experimental local brain lesions. In the zones within a 15-mm distance from the lesion focus, a decrease in the local blood flow was observed, with a minimum on the 2nd to 5th day after the lesion, followed by normalization on the 10th-14th day. The cerebrovascular reactivity to CO₂ decreased and returned to normal in a fashion similar to that exhibited by the blood flow, indicating that the vascular reactivity can serve as a valuable criterion in evaluating the process of functional restoration in brain tissue. I.S.

A86-45321

CHANGES IN PERICARDIAL MICROCIRCULATION IN DOGS DURING ADAPTATION TO STATIC MUSCLE LOADS [IZMENENIIA MIKROTSIRKULIATsii PERIKARDA U SOBAK PRI ADAPTATSII K STATICHESKIM MYSHECHNYM NAGRUZKAM]

V. A. SHESTAKOV, A. V. MURAVEV, and L. G. ZAITSEV (Gosudarstvennyi Pedagogicheskii Institut, Yaroslavl, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 72, May 1986, p. 625-631. In Russian. refs

Physiological changes in cardiovascular and respiratory systems were correlated with morphological changes taking place in the pericardial microcirculatory system of dogs adapted for 6 weeks to loads sustained daily for 1 hr at a time. The observed changes in pulse rate, respiratory rate, oxygen consumptions, and vascular permeability, which indicated increased efficiency of the cardiovascular and respiratory systems, were accompanied by beneficial morphological changes in the pericardial microcirculation. These changes included decreased vascular diffusion area, capillary diameters, and blood volume, and an increased number of capillary vessels. All changes reversed during deadaptation. I.S.

A86-45322

THE CONTRACTILE FUNCTION AND THE ENERGY METABOLISM OF THE MYOCARDIUM UNDER EMOTIONAL STRESS AND DURING ADAPTATION OF ANIMALS TO SHORT STRESS EFFECTS [SOKRATITEL'NAIA FUNKTSIIA I ENERGETICHESKII METABOLIZM MIOKARDA PRI EMOTSIONAL'NOM STRESSE I ADAPTATSII ZHIVOTNYKH K KOROTKIM STRESSORNYM VOZDEISTVIAM]

V. V. MALYSHEV, L. S. KATKOVA, V. I. LIFANTEV, and T. P. DVORETSKAIA (Gosudarstvennyi Meditsinskii Institut, Irkutsk, USSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 72, May 1986, p. 632-636. In Russian. refs

A86-45323

THE EFFECT OF HYPOXIA ON THE DYNAMICS OF THE PERIPHERAL LYMPH FLOW [DINAMIKA IZMENENII PERIFERICHESKOGO LIMFOTOKA PRI DEISTVII GIPOKSII]

S. G. TOPOROVA (Tadzhikskii Gosudarstvennyi Meditsinskii Institut Dushanbe, Tadzhik SSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 72, May 1986, p. 642-649. In Russian. refs

The effect of hypoxia (1-60 min at 5000 m in a decompression chamber) on the dynamics of the direction and speed of the lymph flow in the mesenteric vessels of rats with exposed mesenterium was investigated by means of an attached microscopic installation. The vessels' locomotor reaction to hypoxia and the changes in the vessel valve activity were also observed. Five minutes after introduction of the hypoxic condition, an increase in the lymph flow was observed, due to the following compensatory changes in the lymph vessels: a vasodilation, a decrease in the frequency of the spontaneous changes in the vessel lumen and an increase in the amplitude of these changes, and a synchronization of locomotion in lymphangiomas. During the duration of hypoxia the lymph valves remained open, with a steady distance maintained between the cuspat ends, except for brief periods of closing during equilibration of hydrostatic pressure between adjacent vessel segments. It is suggested that the funnel-like shape of the lymph valve causes a hydrostatic pressure drop (due to increased flow speed), in its narrow segment leading to a sucking effect, which in turn promotes lymph movement. I.S.

A86-45324

THE CONTENT OF LACTIC ACID IN THE BLOOD AND ERYTHROPOIESIS DURING HYPOXIA [SODERZHANIE MOLOCHNOI KISLOTY V KVOVI I ERITROPOEZ V USLOVIAKH GIPOKSII]

M. IA. SHCHUKINA (AN KSSR, Institut Fiziologii i Eksperimental'noi Patologii Vysokogori'ia Frunze, Kirgiz SSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 72, May 1986, p. 668-672. In Russian. refs

The effects of acute blood loss and elevated altitude on the blood titers of lactic acid, erythrocytes, and hemoglobin were studied in rats bled to 20 to 25 percent blood loss and adapted to 760 m above the sea level, and then to 1700 m. Acute blood loss caused a threefold increase in lactic acid concentration as soon as 20 min after the bleeding, while the erythropoietic indices changed only days later. By the time the hemoglobin and erythrocyte titers increased significantly, the lactic acid titer was again at the control level. The degree of lactacemia was found to decrease with adaptation to high altitude, and was lower in female, compared with male, rats. The observed sequence of the lactacemic and erythropoietic changes supports the hypothesis of the lactacemia-induced onset of erythropoiesis. I.S.

A86-45960* Salk Institute for Biological Studies, San Diego, Calif.

TEMPLATE-DIRECTED OLIGONUCLEOTIDE LIGATION ON HYDROXYLAPATITEO. L. ACEVEDO and L. E. ORGEL (Salk Institute for Biological Studies, San Diego, CA) Nature (ISSN 0028-0836), vol. 321, June 19, 1986, p. 790-792. refs
(Contract NGR-05-067-001)

It has been suggested that the prebiotic synthesis of the precursors of biopolymers could have occurred on a solid surface such as that provided by clay or some other mineral. One such scheme envisages that growing polymers were localized by adsorption to a mineral surface where an activating agent or activated monomers were supplied continuously or cyclically. Here, it is reported that a sequence of reactions in which initially formed oligo(G)s are reactivated by conversion to phosphorimidazolides in the presence of poly(C) and then allowed to ligate is ideal, in that repeated cycles can be carried out on the surface of hydroxylapatite, whereas in the liquid phase the cycle could be achieved only with considerable difficulty. C.D.

A86-46960#

SPACE STATION - LIFE SCIENCESR. S. YOUNG (Management and Technical Services Co., Washington, DC) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 4 p.
(AIAA PAPER 86-2346)

The use of the Space Station for biomedical research and the study of biological cellular and subcellular processes is described. The research will require: (1) a health maintenance facility, (2) a life science research facility, and (3) instruments and platforms for automatic experiments. Experiments analyzing physiological changes induced by microgravity and the relationship between gravity, cellular and organismal physiology, and biochemistry are to be performed on the Station. The development of closed ecological life support systems is to be studied on the Space Station. The Station's facilities are also to be utilized to examine the interaction of the earth's biota with the planet environment, and the origin, evolution, and distribution of life throughout the universe. I.F.

N86-30302*# National Aeronautics and Space Administration, Washington, D.C.

LIFE SCIENCES SPACE STATION PLANNING DOCUMENT: A REFERENCE PAYLOAD FOR THE LIFE SCIENCES RESEARCH FACILITY

Aug. 1986 132 p

(NASA-TM-89188; NAS 1.15:89188) Avail: NTIS HC A07/MF

A01 CSDL 06B

The Space Station, projected for construction in the early 1990s, will be an orbiting, low-gravity, permanently manned facility providing unprecedented opportunities for scientific research. Facilities for Life Sciences research will include a pressurized research laboratory, attached payloads, and platforms which will allow investigators to perform experiments in the crucial areas of Space Medicine, Space Biology, Exobiology, Biospherics and Controlled Ecological Life Support System (CELSS). These studies are designed to determine the consequences of long-term exposure to space conditions, with particular emphasis on assuring the permanent presence of humans in space. The applied and basic research to be performed, using humans, animals, and plants, will increase our understanding of the effects of the space environment on basic life processes. Facilities being planned for remote observations from platforms and attached payloads of biologically important elements and compounds in space and on other planets (Exobiology) will permit exploration of the relationship between the evolution of life and the universe. Space-based, global scale observations of terrestrial biology (Biospherics) will provide data critical for understanding and ultimately managing changes in the Earth's ecosystem. The life sciences community is encouraged to participate in the research potential the Space Station facilities will make possible. This document provides the range and scope of typical life sciences experiments which could be performed within a pressurized laboratory module on Space Station. Author

N86-31207# Naval Research Lab., Washington, D. C.

ADVANTAGES OF THE GAS EXCHANGE APPROACH TO MICROBIOLOGICAL STUDIES Memorandum Report, 1983 - 1985

P. J. HANNAN and D. S. JONES 3 Apr. 1986 43 p

(AD-A166887; NRL-MR-5744) Avail: NTIS HC A03/MF A01

CSDL 06M

Studies of the effects of various chemical or physical stimuli on the growth rates of microorganisms generally involve some measure of biomass. In the case of algae, one might measure the cell number, the chlorophyll concentration, the fluorescence, or the wet weight of the culture as a function of time. Each such measurement requires a sampling of the culture which could be a disturbing factor in the system being measured. Another disadvantage of these traditional measurements is that the times required for significant change to take place in the culture might be hours or days; furthermore, growth rate measurements calculated from the data must be based on the assumption that during the time between measurements the growth rate was

constant. This report describes another approach to the problem. It consists simply of monitoring the O₂ or CO₂ concentration of an air stream passing through the system (the gas exchange method), and it has several distinct advantages: (1) there is no need to take samples of the culture, (2) each measurement is a rate measurement and indicates the performance of the culture at that very moment, and (3) transitory changes in growth rates are readily detected. Examples are given of studies made previously with this method at NRL. Also the possible value of these methods in a study of the corrosion susceptibility of alloys is described.

GRA

N86-31208# Georgia Univ., Athens. Dept. of Chemistry.
**THE PREDICTION OF BIOLOGICAL ACTIVITY USING
 MOLECULAR CONNECTIVITY INDICES**

D. H. ROUVRAY 23 Apr. 1986 31 p

(Contract N00014-84-K-0365)

(AD-A166986; TR-21) Avail: NTIS HC A03/MF A01 CSCL 06O

A highly influential paper by Randic entitled On characterization of molecular branching appeared in the Journal of the American Chemical Society. In this paper a new topological index was introduced which has since become known as the molecular connectivity index. Topological indices (Tis) are graph-theoretical invariants which are employed extensively as mathematical descriptors for a wide range of molecular species. They have been used mainly for the purpose of correlating the properties of molecular species with their topological structure. The molecular connectivity index was originally put forward with the aim of characterizing the branching in alkane species, but more recently has been shown to have numerous applications in both the physical and biological sciences. In this review we shall focus on the use of the index in the more biologically oriented sciences, such as pharmacology and toxicology. In particular, we shall discuss the prediction of biological activity in chemical species by means of this index. The molecular connectivity index as originally presented by Randic was designed to parallel the ordering obtained for sets of isomeric alkane molecules based on their physicochemical properties.

GRA

N86-31209# University of Southern California, Los Angeles.
**LASER KINETIC SPECTROSCOPY OF UNIMOLECULAR AND
 BIMOLECULAR PROCESSES IN THE GAS PHASE Final Report,**
 1 Oct. 1982 - 30 Sep. 1985

C. WITTIG and H. REISLER 15 Nov. 1985 14 p

(Contract AF-AFOSR-0022-83)

(AD-A166998; AFOSR-86-0226TR) Avail: NTIS HC A02/MF A01 CSCL 07E

This research is concerned with the study of unimolecular processes in the gas phase. We concentrated on simple bond fission reactions, and determined both the collision free unimolecular rates Benzylamine (C₆H₅CH₂NH₂), Nitrosomethane (CH₃)₃CNO), and the energy disposal in the products Nitrosyl cyanide (NCN₀), Trifluoronitrile methane (CF₃CN), Cyanogeniodide (ICN). Most of the molecules were dissociated either via IRMPD(CF₃CN, C₆H₅CH₂NH₂) or by electronic excitation followed by radiationless transitions (NCN₀(CH₃)₃CNO). They exhibited statistical behavior, and the results were compared with the predictions of statistical theories. The most detailed experiments involved the photodissociation of NCN₀, which provided complete mapping of product internal states. The CN and NO E,V,R distributions are textbook examples of statistical product state distributions deriving from a unimolecular reaction. In our studies of the direct photodissociation of ICN, we obtained sub-Doppler LIF spectra of nascent CN(X² sigma state), following the 266 nm photolysis of 300 K molecules. These studies provided a detailed picture of the fragment recoil spatial anisotropies as well as CN E,V,R, T and and I/I excitations. The CN rotational distributions were dissected into two separate distributions for the channels producing I and I.

GRA

AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and weightlessness.

A86-43750

**THE INVERSE PROBLEM IN ELECTROCARDIOGRAPHY - A
 MODEL STUDY OF THE EFFECTS OF GEOMETRY AND
 CONDUCTIVITY PARAMETERS ON THE RECONSTRUCTION OF
 EPICARDIAL POTENTIALS**

B. J. MESSINGER-RAPPORT and Y. RUDY (Case Western Reserve University, Cleveland, OH) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol. BME-33, July 1986, p. 667-676. Research supported by the American Heart Association and North East Ohio Affiliate, Inc. refs

(Contract NIH-HL-33343; NIH-HL-17931; NIH-GM-07250)

An eccentric spherical model is utilized to study the effects of variations in torso geometry and volume conductivity parameters on the accuracy of the recovered epicardial potentials and the orthogonal expansion terms. The solution to the electrocardiographic inverse problem of the eccentric sphere is presented. The ability to distinguish separate local electrical events on the epicardium is examined. The data reveal that changes in the conductivity and geometry parameters influence the amplitude, resolution, and position of the reconstructed epicardial potentials; proper estimations of secondary sources external to the epicardium and geometry parameter are necessary for accurate recovery of epicardial potentials. The application of the homogeneous assumption to inverse-recovered epicardial potentials results in good recovery of anterior epicardial potentials; however, resolution loss for posterior potentials is detected. Deviations in the conductivity of the lungs and skeletal muscle tissue and incorrect estimation of the heart size affect the recovery of the anterior and posterior epicardial potentials.

I.F.

A86-44087

CIRCADIAN VARIATIONS OF SYSTOLIC TIME INTERVALS

J. TIMBAL, J. COLIN, and H. MAROTTE (Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris, France) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, July 1986, p. 642-646. refs

In order to test the reality of a circadian evolution of systolic time intervals, an experiment was conducted on six subjects resting in a supine position for 24 h. Heart rate (HR), systole (S), diastole (D), presystole (PS), isovolumetric contraction time (IVCT), normal and corrected ventricular preejection and ejection time were computed by electric rheoplethysmography every 3 h in supine and sitting positions. Evidence of the existence of a circadian rhythm was clear in supine subjects; especially left preejection period (LPEP) and left ventricular ejection time (LVET) acrophases were, respectively, 4.03 ± or - 2.36 h and 4.31 ± or - 1.15 h. In sitting subjects, a circadian rhythm was evidenced for IVCT, corrected left ventricular ejection time, and LPEP/LVET, and on the difference of resting-sitting for PS, IVCT, and LPEP, suggesting a decrease in orthostatic tolerance at the end of the night. However, values for characteristics of circadian rhythms (mean, amplitude, phase) strongly depend upon experimental conditions (position, activity, diet). A phase difference between systolic times and HR was also observed. This phenomenon was due to an advance in phase of D relative to S. Finally, all these results show that it is always necessary to take circadian factors into consideration during cardiovascular studies, especially for the preparation of protocols and the interpretation of results.

Author

A86-44088
NALOXONE ENHANCES MOTION SICKNESS - ENDORPHINS IMPLICATED

M. E. ALLEN, C. MCKAY, D. M. EAVES, and D. HAMILTON (Simon Fraser University, Burnaby; Lions Gate Hospital, North Vancouver, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, July 1986, p. 647-653. refs

This study evaluated the time course to malaise III in human subjects given naloxone and placebo with a double-blind crossover protocol in the prevention of motion sickness induced by exposure to coriolis stimulation in a rotating chair. During naloxone tests, subjects reached the designated level of sickness sooner than during the placebo testing (significance greater than 0.05) and their discomfort lingered for up to 3 d, a feature not seen with the placebo. This implicates endogenous opiates with an endogenous protective or adaptive role in the control of motion sickness. It is suggested that when subjects experience endogenous opioid withdrawal, such as post exercise, they could be in a state of neuron hypersensitivity, and thus more prone to any form of exogenous emetic stimuli. Greater tolerance to motion stresses could be experienced in subjects whose endorphins were repeatedly elevated, thus avoiding a hypersensitivity state from endogenous opiate withdrawal. Subjects whose endorphins have not been elevated in the first instance cannot secondarily suffer opioid abstinence. Author

A86-44089
SINGLE SINUSOIDS COMPARED WITH A MULTIPLE-SINUSOIDS TECHNIQUE FOR EVALUATING HORIZONTAL SEMICIRCULAR CANAL FUNCTION

J. W. WOLFE, E. J. ENGELKEN, K. W. STEVENS, and J. E. OLSON (USAF, School of Aerospace Medicine, Brooks AFB; USAF, Medical Center, Lackland AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, July 1986, p. 667-670. refs

The vestibulo-ocular reflex (VOR) of 162 normal subjects was evaluated using two rotational testing procedures. Data from 79 subjects were collected using a set of five single-frequency stimuli (0.01 to 0.16 Hz) and 83 subjects were tested using multifrequency stimuli (0.01 to 0.27 Hz). The use of multifrequency stimuli in place of single frequencies reduced testing time from 75 min to 20 min per subject. The diagnostically useful phase response of the VOR, as estimated by the two tests, were not statistically different. Equivalent phase measures may be obtained within a shorter testing period using the multifrequency procedure. Author

A86-44090
INHIBITORY EFFECTS OF COMBINED AGONIST AND ANTAGONIST MUSCLE VIBRATION ON H-REFLEX IN MAN

B. J. MARTIN (Institut National de Recherche et de Sécurité pour la Prévention des Accidents du Travail et des Maladies Professionnelles, Vandoeuvre, France), J. P. ROLL, and G. M. GAUTHIER (Aix-Marseille I, Université, Marseille, France) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, July 1986, p. 681-687. Research supported by Institut National de Recherche et de Sécurité pour la Prévention des Accidents du Travail et des Maladies Professionnelles and CNRS. refs

The differential effects of vibration locally applied to gastrocnemius soleus and tibialis anterior muscles separately and to both muscles simultaneously are studied. From the results, it is deduced that combined agonist and antagonist muscle vibration may lead to summative interaction between pre- and postsynaptic inhibition at motoneuronal level. Whole-body vibration is taken to mean a combination of synchronous vibrations applied locally and simultaneously to several muscles. The results also demonstrate that the level of inhibition of the H-reflex resulting from the vibration is directly related to the displacement amplitude of the vibration, regardless of the frequency. Author

A86-44091
THE POSSIBLE INVOLVEMENT OF PGI₂ IN THE PEEP-INDUCED CHANGES IN CARDIAC OUTPUT AND BLOOD PRESSURE

W. DURANTE and F. A. SUNAHARA (Toronto, University, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, July 1986, p. 688-693. Research supported by the Ontario Heart Foundation and Department of National Defence of Canada. refs

Ventilation with positive end-expiratory pressure (PEEP) is employed in clinical and aviation medicine. The widespread application of PEEP, however, is limited principally because of its adverse effect on cardiac output (CO) and systemic arterial blood pressure (BP). Recently, it has been suggested that this PEEP-induced cardiovascular depression may be mediated by vasoactive agents, possibly prostaglandin in nature. This study examined the possible involvement of PGI₂ in the PEEP-induced decreases in CO and BP. Chloralose-anesthetized mechanically ventilated dogs were subjected to brief intervals (75 s) of PEEP 10 or 20 mm Hg. Arterial levels of 6-keto-PGF_{1a} (stable metabolite of PGI₂) were monitored by radioimmunoassay. These parameters were compared before and during PEEP application. During PEEP, tracheal pressure-related decreases in both CO and BP were noted. Application of either PEEP 10 or 20 mm Hg resulted in an increase in circulating 6-keto-PGF_{1a} levels in three animals while a decrease was noted in two others. Overall, application of PEEP did not result in a significant change from baseline levels. Furthermore, there was no correlation between changes in either CO or BP with changes in arterial 6-keto-PGF_{1a} levels. These results do not support the hypothesis that the short term PEEP-induced changes in CO or BP are mediated by endogenously released PGI₂. Author

A86-44092
LOW BACK PAIN IN PILOTS

P. FROOM, J. BARZILAY, Y. CAINE, S. MARGALIT, D. FORECAST (Israel Air Force, Aeromedical Center, Ramat Gan) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, July 1986, p. 694, 695. refs

A questionnaire on low back pain (LBP) was administered to 373 fighter pilots, 165 transport pilots, and 264 helicopter pilots. Helicopter pilots had more pain during flight than did fighter or transport pilots (34.5, 12.9, and 5.1 percent, respectively). A history of LBP temporally unassociated with flight was found in 26.5 percent of helicopter pilots, 31.5 percent of transport pilots, and 25.2 percent of fighter pilots. It is concluded that, despite the pain experienced by helicopter pilots in flight, they are not at increased risk for LBP unassociated with flight. Author

A86-44093
DIFFUSE PULMONARY OSSIFICATION AND SPONTANEOUS PNEUMOTHORAX IN A PILOT - A CASE REPORT

P. F. EKHOLDT, B. R. OPPEDAL, and P. ARVA (National Hospital; Luftfartsverket, Oslo, Norway) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, July 1986, p. 696-698. refs

A86-44095
THE SIGNIFICANCE OF RECURRENT CHILDHOOD RESPIRATORY DISORDERS IN FLIGHT TRAINING APPLICANTS

M. FELDMAN, P. FROOM, Y. CAINE, S. MARGALIT, and J. BENBASSAT (Israel Air Force, Aeromedical Center, Ramat Gan; Hadassah University Hospital, Jerusalem) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, July 1986, p. 706-708. refs

A random sample of 1700 18-year-old applicants for flight training, who had been free from respiratory symptoms for one year or more was screened for respiratory symptoms in the past. Those who denied such a history had a questionnaire sent to their parents for further verification. Altogether 70 subjects with a past history of 'wheezing', 'asthma', or 'spastic bronchitis' were thus identified. Abnormalities in either FEV₁/FVC, Vmax₅₀ or Vmax₇₅ were found in 40 percent of the subjects with a history of childhood 'wheezing', 'asthma', or 'spastic bronchitis', but only

in 8 percent of controls without such a history. A history of wheezing had no effect on the residual volume/total lung capacity ratio. The age at which the last bout had occurred had no apparent effect on the degree of flow abnormalities. The most sensitive index for a flow abnormality was V_{max50} , which was less than 74 percent of the predicted values in 27 (30 percent) of the 70 subjects tested. It is concluded that, in subjects with a history of 'wheezing', 'asthma', or 'spastic bronchitis', flow abnormalities may persist even after prolonged remissions. Author

A86-44096

PHYSICAL TRAINING AND +GZ TOLERANCE REEVALUATED
R. BULBULIAN (Kansas State University of Agriculture and Applied Science, Manhattan) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, July 1986, p. 709-711. refs

The effect of physical training on +Gz tolerance is of vital interest in the aerospace community. The data on the effect of physical training on orthostatic tolerance or simulated air combat maneuvers is equivocal. The effects of aerobic and strength training programs is briefly reviewed. The data suggest a need for careful reinterpretation of research results in light of conflicting reports and methodological shortcomings. Aerobic training cannot be assumed to always be detrimental nor can strength training be assumed to be universally effective in improving +Gz tolerance. In selecting appropriate screening criteria and training regimens for aircraft personnel, it seems prudent to reinvestigate strength and endurance training effects on +Gz tolerance using multivariate research paradigms. Special attention should be directed to commonly accepted physiological principles which may vary under conditions of altered gravitation. Author

A86-44097

SIMULATED AERIAL COMBAT MANEUVERING TOLERANCE AND PHYSICAL CONDITIONING - CURRENT STATUS

R. R. BURTON (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, July 1986, p. 712-714. refs

A86-44194

EFFECT OF HEAD-OUT WATER IMMERSION ON RESPONSE TO EXERCISE TRAINING

L. M. SHELD AHL, F. E. TRISTANI, P. S. CLIFFORD, J. H. KALBFLEISCH, and G. SMITS (USVA, Cardiopulmonary Rehabilitation Center, Wisconsin, University, Milwaukee) Journal of Applied Physiology (ISSN 0161-7567), vol. 60, June 1986, p. 1878-1881. Research supported by the Wisconsin Heart Association. refs
(Contract USVA-7876-01P)

During spaceflight and head-out water immersion (WI) there is a cephalad shift in blood volume. It has recently been shown that left ventricular end-diastolic dimension is significantly greater during moderate cycling exercise with WI compared with on land. The purpose of this study was to determine whether the cephalad shift in blood volume and accompanying increase in cardiac preload with WI alters the normal cardiovascular adaptations to aerobic exercise training. Nine middle-aged healthy men trained on cycle ergometers in water, nine trained on land, and four served as controls for 12 wk. Following training, both training groups showed similar increases (P less than 0.05) in stroke volume and similar decreases in heart rate (P less than 0.01) and blood pressure (P less than 0.05) at a given submaximal exercise O_2 consumption. Maximal O_2 consumption increased (P less than 0.01) similarly for both training groups. The control group did not demonstrate any significant changes in submaximal or maximal exercise responses. It is concluded that the cephalad shift in blood volume with WI does not alter the normal cardiovascular adaptation to aerobic exercise training. Author

A86-44778

HUMAN FACTORS PROBLEMS IN THE TACTICAL AIR COMMAND

R. M. DEHART (USAF, Tactical Air Command, Langley AFB, VA) SAFE Journal, vol. 16, no. 2, Summer 1986, p. 18-20.

The increase in human-factor (HF) variable mishaps to 60-70 percent of the USAF aircraft mishaps in 1984 and 1985 is discussed. The most important HF problems are accelerative force problems, particularly spatial disorientation (SD) and high-G loss of consciousness. SD mishaps account for 30 percent of the F-16 HF mishaps and 19 percent of the F-15 and F-4 HF mishaps. Current medical screening policies to minimize high-G mishaps include coronary artery risk evaluations and hyperlipemia selection standards. High-G fighter pilot training is also being implemented. R.R.

A86-44780

INFLIGHT LOSS OF CONSCIOUSNESS - A FIRST LOOK AT THE U.S. NAVY EXPERIENCE

D. C. JOHANSON (U.S. Navy, Naval Weapons Center, China Lake, CA), H. T. PHEENY (U.S. Navy, Naval Air Systems Command, Washington, DC), J. F. PALMER (U.S. Navy, Pacific Missile Test Center, Point Mugu, CA), and R. A. MATTHEWS (U.S. Navy, Naval Hospital, Rota, Spain) SAFE Journal, vol. 16, no. 2, Summer 1986, p. 30-35. Navy-sponsored research.

This paper represents the first public release of a recent NAVAIR-sponsored survey studying the incidence of in-flight acceleration (g) induced loss of consciousness (GLOC) in the United States Navy. The survey provides some valuable information on aviator attitudes, practices, and performance, in addition to suggesting the requirement for a follow-up study. The survey indicated a 12 percent incidence of GLOC within the Navy, which is in agreement with the findings of the Air Force study of two years previous which also indicated a rate of 12 percent for that service. The primary goal of this survey was to determine the relative incidence of GLOC. However, in the process, the survey examined a number of items of potential interest to the life support systems designer which may prove beneficial to future designs. In addition to discussing the primary goal, this report looks at several areas of potential interest with respect to the life support aspects of the flight environment. Author

A86-44814

G-INDUCED LOSS OF CONSCIOUSNESS - COMBAT AIRCRAFT PILOTS HEAD FOR TROUBLE

G. CHAMBOST and P. TURK Interavia (ISSN 0020-5168), vol. 41, May 1986, p. 507, 508.

The problem is examined of modern combat aircraft being able to sustain G forces greater than their pilots can tolerate and remain conscious. Between 1983 and 1984, the U.S. Air Force officially acknowledged nine accidents in which loss of consciousness under high G loads was deemed to have been the primary cause. An aircraft such as the F-16 or Mirage 2000 can not only maintain loads of 9G for several tens of seconds but can also reach these high values in only a few seconds; the body has no time to organize its automatic defense mechanisms such as accelerated heart rate and increased blood pressure. Studies at the Air Force School of Aerospace Medicine indicate that the ability of the cardiovascular system to maintain correct irrigation of the brain is inversely proportional to the rate of onset of G forces; this is why the problem is so serious in high performance combat aircraft. Techniques for dealing with the problem (inclined crew seats, G suits) are considered. The G-LOC (G-induced loss-of-consciousness) problem has been shrouded in mystery in part because of a knowledge of how far one has pushed back the limits of G tolerance is of great interest to an adversary. D.H.

A86-45254*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

FLUID DYNAMIC STUDY IN A FEMORAL ARTERY BRANCH CASTING OF MAN WITH UPSTREAM MAIN LUMEN CURVATURE FOR STEADY FLOW

Y. I. CHO, L. H. BACK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and M. R. BACK ASME, Transactions, Journal of Biomechanical Engineering, vol. 107, Aug. 1985, p. 240-248. NASA-supported research. refs
(Contract NIH-HL-23619-05)

An in-vitro, steady flow investigation was conducted in a hollow, transparent vascular replica of the profunda femoris branch of man for a range of physiological flow conditions. The replica casting tested was obtained from a human cadaver and indicated some plaque formation along the main lumen and branch. The flow visualization observations and measured pressure distributions indicated the highly three-dimensional flow characteristics with arterial curvature and branching, and the important role of centrifugal effects in fluid transport mechanisms. Author

A86-45325

THE EFFECT OF HIGH TEMPERATURE ON THE HEAT EXCHANGE AND THE NUTRITIONAL STATUS OF PILOTS [VLIANIE VYSOKOI TEMPERATURY NA TEPLOOBMEN I SOSTOIANIE PITANIA U LETCHIKOV]

A. N. AZHAEV, V. E. POTKIN, P. A. LOZINSKII, and V. A. EFIMOV Voenno-Meditsinskii Zhurnal (ISSN 0026-9050), April 1986, p. 39-41. In Russian. refs

Changes in body mass, pulse rate, oral and average skin temperatures, urine volume, and mineral excretion were studied in pilots after flights from moderate climatic zones into zones with higher (by 15 to 20 C) temperatures. In addition, caloric and liquid intakes of the subjects were correlated with their objective evaluation of appetite and thirst, efficiency, and the state of well being. Compared with psychophysiological changes registered in the same pilots after flights within moderate climatic zones, flights into a hotter zone were accompanied by large increases of pulse rate and by other unfavorable changes of the analyzed psychophysiological indices. It is recommended that pilots designated for flights from a moderate into a hot temperature zone be screened on the basis of clinical and physiological tests, and that prophylactic measures be taken against dehydration and overheating of the organism before, during, and after the flight. I.S.

A86-46270

RADIOFREQUENCIES AND MICROWAVES - RADIATION SAFETY OF THE OPERATOR [RADIOIZLUCHENIIA I MIKROVOLNY - RADIATSIONNAIA BEZOPASNOST' OPERATORA]

B. I. DAVYDOV Kosmicheskie Issledovaniia (ISSN 0023-4206), vol. 24, May-June 1986, p. 459-465. In Russian. refs

The radiofrequency and microwave radiation safety standards existing in the USSR, Poland, Czechoslovakia, USA, Canada, Great Britain, and West Germany are examined along with the proposals of the IRPA/INIRC. It is noted that the dosimetric principle provides best results in evaluating biological effects but is associated with certain difficulties in interpretation; therefore the use of the effective dose as a criterion of biological effects is preferable. Some organizational aspects of radiation safety are discussed. V.L.

A86-46938#

AN UPDATED MODEL FOR A SPACE STATION HEALTH MAINTENANCE FACILITY

W. T. HARVEY, S. M. FARRELL, A. J. HOWARD, and F. C. PEARLMAN (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 7 p.
(AIAA PAPER 86-2303)

The Space Station Health Maintenance Facility (HMF) is required to provide 'critical care' capability for one crew-member for 28 days. The HMF must also provide routine monitoring and care for the Space Station crew for the duration of the mission.

The equipment necessary to meet these requirements has been defined and an estimate of the physical characteristics of each piece of equipment has been completed. The equipment has been integrated into two Space Station standard outfitting packages, one which contains the laboratory and data management equipment and one which holds the critical care equipment and X-ray reader. The front panel configuration has been designed for optimum crew interface. The total system weight, volume and power requirements have been estimated at 1500 lbs, 140 cubic feet, and 0.5/2 kilowatts (routine/ critical care). The HMF Medical Data Management System hardware and architecture has been designed to complement the Space Station Data Management System.

Author

N86-30303*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE TEMPORAL RESPONSE OF BONE TO UNLOADING

R. K. GLOBUS, D. D. BIKLE (California Univ., San Francisco.), and E. MOREY-HOLTON 19 Dec. 1984 34 p Prepared in cooperation with Veterans Administration Hospital, San Francisco, Calif.

(Contract NAGW-236)

(NASA-TM-89228; NAS 1.15:89228) Avail: NTIS HC A03/MF A01 CSCL 06P

Rats were suspended by their tails with the forelimbs bearing the weight load to simulate the weightlessness of space flight. Growth in bone mass ceased by 1 week in the hindlimbs and lumbar vertebrae in growing rats, while growth in the forelimbs and cervical vertebrae remained unaffected. The effects of selective skeletal unloading on bone formation during 2 weeks of suspension was investigated using radio isotope incorporation (with Ca-45 and H-3 proline) and histomorphometry (with tetracycline labeling). The results of these studies were confirmed by histomorphometric measurements of bone formation using triple tetracycline labeling. This model of simulated weightlessness results in an initial inhibition of bone formation in the unloaded bones. This temporary cessation of bone formation is followed in the accretion of bone mass, which then resumes at a normal rate by 14 days, despite continued skeletal unloading. This cycle of inhibition and resumption of bone formation has profound implication for understanding bone dynamics during space flight, immobilization, or bed rest and offers an opportunity to study the hormonal and mechanical factors that regulate bone formation. B.G.

N86-30304# Army Research Inst. of Environmental Medicine, Natick, Mass.

THERMOREGULATION AFTER ATROPINE AND PRALIDOXIME ADMINISTRATION

M. A. KOLKA, L. A. STEPHENSON, S. P. BRUTTIG, B. S. CADARETTE, and R. R. GONZALEZ Mar. 1986 19 p
(AD-A165868) Avail: NTIS HC A02/MF A01 CSCL 06O

The effects of intramuscular saline (control), atropine (2mg), pralidoxime (600 mg) or a combination of the two drugs on heat exchange was evaluated in four healthy males during moderately intense seated, cycle exercise (55% v02 peak) in a temperate environment (T sub a = 30.3 C, P sub W = 1.0 kPa). Esophageal, rectal, and mean skin temperatures, and chest and forearm sweating were continuously measured. Skin blood flow (FBF) from the forearm was measured twice each minute by venous occlusion plethysmography. Whole body sweating was calculated from weight changes. The expected result of atropine injection, decreased eccrine sweating (-60%, P 0.05) with ensuing elevated esophageal (+0.4C, P<0.05) and skin temperature (+2.1C, P<0.05) was observed relative to control. Heart rate (+28 b/min) and FBF (+9 ml/100cc) were higher after atropine. Pralidoxime, in general, did not affect the core and skin temperature responses to the exercise differently from control; however, a slightly elevated FBF (+3ml/100cc min, 33%) compensated for the reduction in whole body sweating (-45%, p<0.05) that we observed. The combination of the drugs resulted in significantly higher esophageal (0.4C) and skin (0.9C) temperatures than atropine alone, as has been previously shown. The thermoregulatory disadvantage of inhibited sweating by atropine was partially compensated for by enhanced

skin blood flow in this environment where $T_{sub a} > T_{sub sk}$. Pralidoxime was shown to decrease whole body sweating, by a mechanism as yet unexplained. GRA

N86-30305# Army Research Inst. of Environmental Medicine, Natick, Mass.

HUMAN VASCULAR FLUID RESPONSES TO COLD STRESS ARE NOT ALTERED BY COLD ACCLIMATION

A. J. YOUNG, S. R. MUZA, M. N. SAWKA, and K. B. PANDOLF
Mar. 1986 26 p
(AD-A165869; USARIEM-M-19/86) Avail: NTIS HC A03/MF A01
CSCL 06S

Repeated cold water immersion can induce the development of an insulative type of cold acclimation in man. This investigation determined if repeated cold water immersion produced changes in vascular fluid response to cold stress in addition to the previously reported changes in thermoregulation. Seven male subjects performed a standardized cold air and cold water exposure before and again after a cold acclimation program. The cold acclimation program consisted of daily immersion (90 min) in cold water (18 C, stirred) repeated five times per week for five consecutive weeks. Cold acclimation did not alter the responses of plasma volume or electrolyte concentrations, nor urinary flow or electrolyte excretion during either cold air or cold water exposure. The percent reduction in plasma volume was larger ($P < 0.01$) in cold water (-17%) than in cold air (-12%). Cold water immersion resulted in greater ($P < 0.01$) diuresis than cold air exposure. Plasma $K(+)$ concentration increased ($P < 0.01$) during cold (both air and water) exposure while plasma $Na(+)$ concentration was unchanged. Calculated renal clearance and urinary excretion rate of both $Na(+)$ and $K(+)$ increased during cold (both air and water) exposure. It is concluded that: (1) insulative cold acclimation does not influence vascular fluid responses to cold stress; and (2) although vascular fluid shifts, body cooling and diuresis are all greater in cold water than air, a consistent relationship among these parameters could not be established for an individual's response. GRA

N86-30306# Naval Submarine Medical Research Lab., Groton, Conn.

CALCIUM AND VITAMIN D METABOLISM IN SUBMARINERS: CARBON DIOXIDE, SUNLIGHT AND ABSORPTION CONSIDERATIONS

D. M. SACK, M. HOLICK, and K. R. BONDI 15 Jan. 1986 25 p
(AD-A166292; NSMRL-1037) Avail: NTIS HC A02/MF A01
CSCL 06P

A 42% decrease in 25(OH)vitamin D levels has been noted in subjects over the course of submarine patrols and is thought to be the result of prolonged sunlight deprivation. The influence of the submarine environment on absorption of ingested vitamin D has not been previously investigated. This study examines the vitamin D absorption patterns of 5 subjects at the beginning, middle, and end of a 69 day patrol on a normal diet and with no exposure to sunlight. It was found that the magnitude and pattern of absorption does not change appreciably. It is concluded that the absorption of vitamin D is not affected by the submarine environment and that any drop in 25(OH) vitamin D levels seen during patrol is caused by lack of sunlight, ultraviolet light in particular. Implications in terms of sunlight deprivation and calcium metabolism are discussed in a historical review of calcium and vitamin D investigations on submarines. GRA

N86-30307# Army Research Inst. of Environmental Medicine, Natick, Mass.

AN ENVIRONMENTALLY-CONTROLLED EXTENDED-USE SMALL ANIMAL HYPOBARIC CHAMBER

J. A. DEVINE and A. CYMERMAN Apr. 1986 14 p
(AD-A166729; USARIEM-M-23/86) Avail: NTIS HC A02/MF A01
CSCL 06S

An environmentally-controlled extended-use small animal hypobaric chamber has been designed to study small laboratory animals at low barometric pressures for long periods of exposure. The rectangular chamber (91.4 x 71.1 x 50.8 cm) is constructed of aluminum plate and acrylic resin with a volume of 330,000 cc.

A computer/data acquisition control unit provides for controlling and collecting data on pressure, temperature, and relative humidity (RH) for sustained operations. Altitude simulation is achieved using a two-stage, air-cooled vacuum pump with a displacement of 30 cc/min. The pressure within the chamber is controlled by an incremental throttling valve in the vacuum line. Temperature (0-100 C) is accomplished by using a remote-controlled constant temperature circulating bath. RH (20-80%) is regulated by pre-conditioning the ventilation purge air prior to entering the chamber. Acceptable levels of oxygen and carbon dioxide gases are maintained by purging with sufficient volumes of fresh air. GRA

N86-30308# Argonne National Lab., Ill.
MULTIPARAMETER DATA ACQUISITION SYSTEMS FOR STUDIES OF CIRCADIAN RHYTHMS

K. R. GROH, C. F. EHRET, W. J. EISLER, JR., and D. A. LEBUIS
1985 15 p Presented at the NATO Advanced Workshop on Chronobiotechnology, Cardiff, Wales, 21 Apr. 1985
(Contract W-31-109-ENG-38)

(DE86-004041; CONF-8504206-1) Avail: NTIS HC A02/MF A01

Long-term, simultaneous monitoring of multiple metabolic circadian cycles such as energy metabolism, animal activity, and body temperature together have revealed ultradian fine-structure rhythms which are dependent on circadian phase and the perturbations of environmental influences. Because of the variation between individual animals, these experiments need to have large sample sizes for each experimental condition. To this end we have designed, constructed, and used four microcomputer controlled data acquisition systems to collect circadian data from individually housed rats and mice. DOE

N86-30309# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.

MEDICAL SELECTION AND PHYSIOLOGICAL TRAINING OF FUTURE FIGHTER AIRCREW

Loughton, England Dec. 1985 146 p refs In ENGLISH and FRENCH Conference held in Athens, Greece, 25-26 Apr. 1985
(AGARD-CP-396; ISBN-92-835-0385-6) Avail: NTIS H A07/MF A01

The conference proceedings reviewed and made recommendations with respect to the medical selection and physiological and physical training of pilots who are to operate future fighter aircraft. The relevant characteristics of a proposed USAF fighter and the European Fighter Aircraft were discussed and used as the basis for selection and training considerations. Contributors drew upon the experience of the medical selection of pilots for present fighter aircraft. The cardiovascular, vision, and vertebral column aspects of medical selection and monitoring are considered in depth and recommendations made as to the methods which should be employed in the future. The influence of physical fitness upon pilot performance is addressed. The philosophy and practice of physiological training of aircrews is reviewed with emphasis on the value of the human centrifuge in teaching G protective maneuvers.

N86-30310# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

AIRCREW ASPECTS OF UNITED STATES FUTURE FIGHTER AIRCRAFT

R. D. KROBUSEK In AGARD Medical Selection and Physiological Training of Future Fighter Aircraft 5 p Dec. 1985

Avail: NTIS HC A07/MF A01

The cockpit environment of fighter aircraft for the year 2000 and beyond will undoubtedly need aircraft technologies and protective devices to meet the ever growing enemy challenge. Recent advances in aircraft structures, flight controls, sensors, multipurpose and touch-sensitive displays, voice recognition and synthesis, enemy defenses, and chemical/biological warfare (CBW) technologies will combine to create a cockpit environment for future fighter aircraft vastly different and potentially more complex than any previously encountered by aircrews. This integration of

equipment and crewmembers will interact such that new stresses will be created and existing ones aggravated. Special maneuver capability through the use of direct side force may provide significant tactical advantage at the expense of stress due to lateral acceleration forces. A few of these current technologies and some of the driving forces which will affect the cockpit environment of tomorrow's aircraft will be identified and discussed briefly. These technologies, as well as others, should receive further study for their effects on the aircrew prior to application in future aircraft. Proper application of the results of these studies will prevent the unbridled growth of cockpit complexity. Author

N86-30311# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

CANADIAN FORCES APPROACH TO AIRCREW MEDICAL SELECTION

G. GRAY /In AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 6 p Dec. 1985

Avail: NTIS HC A07/MF A01

With advances in aircraft performance capabilities and in medical screening technology, major changes in Canadian Forces aircrew medical screening procedures were proposed and are being introduced. In addition to the standard battery of tests, additional screening procedures being introduced or evaluated include drug screening for cannabinoids, contrast sensitivity function visual assessment, echocardiograms, cardiovascular risk assessment, pulmonary function testing, an aeromedical history questionnaire, and a psychosocial and clinical review by a flight surgeon. Screening electroencephalograms are being continued. This data is used to reject candidates who fail to meet selection standards, and to provide a Medical Suitability Rating for acceptable candidates. Of candidates screened 2.8% had positive tests for urinary cannabinoids. Contrast sensitivity norms for the aircrew candidate population are higher than for other populations studied. Contrast sensitivity may be helpful in assessing candidates whose vision is close to standards. This approach to initial medical screening should reduce attrition of experienced aircrew for medical reasons, and will enhance flight safety over the years to come.

Author

N86-30312# Tactical Air Command, Langley AFB, Va.
MEDICAL SELECTION AND PHYSIOLOGICAL TRAINING OF FIGHTER PILOTS: A 1985 PERSPECTIVE AND OVERVIEW

R. M. DEHART /In AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 5 p Dec. 1985

Avail: NTIS HC A07/MF A01

From an aeromedical perspective, there are two major goals for the Tactical Air Force. The first is to reduce the aircraft mishap rate due to human factor variables. The second is to enhance pilot capability to perform in the modern fighter environment. Fighter pilots can perform in the 9G (sub z) environment effectively and safely if they are properly selected, educated, and trained. In addition to being good aviators, smart, and aggressive, fighter pilots must be physically healthy and in excellent physical condition. A thorough understanding of high-G physiology and the personal physiological flight envelope is needed. Accomplishing the variety of initiatives required to realize these goals is an exciting challenge for the aerospace medical community. Author

N86-30313# School of Aerospace Medicine, Brooks AFB, Tex.
CARDIOVASCULAR STANDARDS FOR SELECTION AND RETENTION OF HIGH PERFORMANCE PILOTS IN THE USAF: PERSPECTIVES FOR THE NEXT DECADE

J. R. HICKMAN, JR., G. M. MCGRANAHAN, JR., R. M. PAULL, and R. M. DEHART (Tactical Air Command, Langley AFB, Va.) /In AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 7 p Dec. 1985

Avail: NTIS HC A07/MF A01

Cardiovascular selection and retention standard must be based upon a number of considerations which are primarily epidemiological in nature. In young applicants, there is little rationale in the performance of expensive, labor intensive studies which yield nonspecific results, most of which are normal variants. Stress

tests and Holter monitors fall into this category. Since the significance of nonspecific findings is determined by the presence or absence of underlying organic structural defects, it is recommended that testing in a young population be directed toward the detection of anatomical defects. It is also recommended that abnormal findings of a structural nature then be assessed with functional tests to determine whether the applicant may enter some form of aviation training or be disqualified from all training. B.G.

N86-30314# Centre Principal d'Expertises Medicales du Personnel Navigant de l'Aeronautique, Paris (France).

SELECTION AND MEDICAL TESTING OF MIRAGE 2000 PILOTS: REPORT OF ECHOCARDIOGRAPHY [SELECTION ET SURVEILLANCE MEDICALES DES PILOTES DE MIRAGE 2000: APPORT DE L'ECHOCARDIOGRAPHIE]

H. ILLE, A. DIDIER, N. ALLEGRI, and C. MAUREL /In AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 13 p Dec. 1985 In FRENCH

Avail: NTIS HC A07/MF A01

The use of echocardiological examinations in the selection of prospective combat aircraft crews is discussed. Included is a comparative study of two homogeneous pilot cohorts; one consists of 34 transport aircraft pilots, and the other consists of 32 combat pilots. It is shown that the two cohorts present the same anomalies of the right cardiac region (mitral valvular prolapsus). However, it is shown that the anomalies of the right cardiac region form a right ventricular dilation only in combat pilots. Two hypotheses were developed: that the anomalies are an adaptation of the right cardiac region to accelerations, or that they are a stage preceding secondary myocardial shock due to aeronautical constraints.

B.G.

N86-30315# Hopital d'Instruction des Armees, Versailles (France).

CONTINUOUS ECG MONITORING OF MIRAGE 2000 PILOTS (COMPARISON WITH MIRAGE 3 AND F1 PILOTS) [ENRIGISTREMENT CONTINU DE L'E.C.G. CHEZ LES PILOTES DE MIRAGE 2000 (COMPARAISON AVEC LES PILOTES DE MIRAGE 3 ET F1)]

A. SEIGNEURIC, G. LEGUAY, J. P. BURLATON, G. POYOT, and M. SYLVESTRE /In AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 3 p Dec. 1985 In FRENCH

Avail: NTIS HC A07/MF A01

Continuous Electrocardiographic monitoring for a duration of 24 hours allows a comparison of a sample of 24 conventional combat aircraft pilots (Mirage III and F1), with 7 Mirage 2000 pilots. A comparison of problems due to excitability during flight does not show significant differences among the two groups. Problems due to solar repolarization were recorded only for high-performance aircraft pilots. Differences primarily included cardiac frequencies in flight; they were clearly lower for the Mirage 2000 pilots as observed acceleration was increased. This corresponds with the differences in characteristics of the two populations, pertaining to the different missions. It is shown that modern combat aircraft, characterized by intense and prolonged acceleration, are capable of causing a certain excitability factor for the pilots. It is important to determine the influence of this acceleration on the cardiovascular system. B.G.

N86-30316# Centre d'Essais en Vol, Bretigny-sur-Orge (France).

THE USE OF ECG CHANGES CAUSED BY ACCELERATION AS TOLERANCE PREDICTION FACTORS [LES MODIFICATIONS ELECTROCARDIOGRAPHIQUES INDUITES PAR LES ACCELERATIONS, FACTEUR PREDICTIF DE LA TOLERANCE]

J. H. CLERE, H. VIELLEFORD, and J. L. POIRIER /In AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 7 p Dec. 1985 In FRENCH

Avail: NTIS HC A07/MF A01

High-G accelerations experienced by combat aircraft pilots are arrhythmogenic. Of 328 electrocardiographic (EKG) tests done on

146 subjects submitting to accelerations of 4 to 11 G at a duration of 20 to 60 seconds, 215 supraventricular anomalies were observed on 181 tests, and 37 ventricular anomalies were observed on 31 tests. The frequency of these anomalies are a function of the intensity of the acceleration. However, there appeared to be no correlation between the EKG anomalies and the hemodynamic phenomena caused by problems of visual function or psychomotor problems. Thus it is stated that EKG monitoring may be of interest for use as a prediction factor for acceleration tolerance. It is stated that the anomalies of rhythm are probably based on vagus reflexes caused by attempts by the heart to protect against the acceleration, as well as by the venous responses to the centrifuge. B.G.

N86-30317# Royal Air Force Inst. of Aviation Medicine, Farnborough (England).

ENTRY VISUAL STANDARDS AND OCULAR EXAMINATION TECHNIQUES FOR FUTURE FIGHTER AIRCREW

D. H. BRENNAN *In* AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 6 p Dec. 1985

Avail: NTIS HC A07/MF A01

The visual tasks of future fighter aircrew are likely to increase both in magnitude and complexity. The increasing adoption of devices for visual enhancement and protection, even now, poses problems for integration with spectacles. The visual standards required for initial selection for training as a pilot or navigator should, if numbers permit, be such that trained aircrew are unlikely to require a visual aid until presbyopia physiologically demands correction in the latter half of the fourth decade. The visual standards considered appropriate for future fighter aircrew and the related ocular examination techniques both conventional and those designed to test such specialized ocular functions as stereopsis, glare resistance, dark adaptation, hue discrimination, and modulation transfer function are discussed. Author

N86-30318# Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris (France).

SENSITIVITY TO COLOR CONTRASTS AND THE SELECTION OF NAVIGATOR PERSONNEL [SENSIBILITE AU CONTRASTE EN COULEURS ET SELECTION DU PERSONNEL NAVIGANT]

J. P. MENU, G. SANTUCCI, and C. CORBE *In* AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 8 p Dec. 1985 *In* FRENCH

Avail: NTIS HC A07/MF A01

Using a specific psychophysical method, the sensitivity to color contrasts (FSC) was systematically tested for subjects undergoing ophthalmological examinations. Following FSC examinations, several subjects with ametropic conditions were studied. The FSC examinations were modified to obtain the exact nature of the ophthalmological problem. It is shown that there is a change in the spatial frequencies of the blue section for subjects with myopic disorders, and a change in the red section for far-sighted subjects. This change is shown to be proportional to the degree of ametropic disorder. Thus, FSC tests are proposed as a basis for tests for the selection of navigators. B.G.

N86-30319# School of Aerospace Medicine, Brooks AFB, Tex. Neurosciences Function.

COMPUTER ANALYSIS OF VISUAL AND VESTIBULAR OCULOMOTOR FUNCTION IN THE MEDICAL SELECTION OF FIGHTER AIRCREW MEMBERS

J. W. WOLFE, E. J. ENGELKEN, and K. STEVENS, W. *In* AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 6 p Dec. 1985

Avail: NTIS HC A07/MF A01

Methods for evaluating visual and vestibular-oculomotor function in aircrew members are reviewed. Three specific tests are described: pursuit tracking, harmonic angular acceleration, and saccadic tracking. In all of these tests, on-line computer analysis is used to quantify and describe the input/output relationships. An example of clinical data from pursuit tracking and harmonic angular acceleration tests for a patient with known pathology are used to demonstrate changes in test results. The major point is that it is

now practical to evaluate oculomotor function in pilots and aircrew members selected for fighter aircraft duty. Author

N86-30320# Naval Aerospace Medical Research Lab., Pensacola, Fla.

VISUAL CAPABILITIES RELATED TO FIGHTER AIRCREW PERFORMANCE IN THE F-14 AND ADVERSARY AIRCRAFT

W. A. MONACO and P. V. HAMILTON *In* AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 9 p Dec. 1985

Avail: NTIS HC A07/MF A01

Standards for aviation personnel should be based on capacities for performing critical tasks. The use of scores on task-relevant visual tests to predict air-to-air target detection performance of pilots involved in air combat maneuver (ACM) training was determined. A series of automated vision tests was determined in a mobile field laboratory located at a Tactical Air Combat Training System (TACTS) range. A computerized telemetry network provides extensive real time data on observer and target aircraft flight dynamics, and environmental parameters. A pilot's performance on each ACM engagement was measured by the slant range at the instant he sighted a target aircraft. Primary analyses show that about 30% of the variance in the slant range is accounted for by flight dynamics, and environmental parameter, and vision data. Author

N86-30321# Naval Aerospace Medical Research Lab., Pensacola, Fla.

VISION TEST BATTERY THRESHOLD AND RESPONSE TIME AS PREDICTORS OF AIR-TO-AIR VISUAL TARGET ACQUISITION IN F-14 AND ADVERSARY AIRCRAFT

A. MORRIS, P. V. HAMILTON, W. A. MOREY, and R. P. BRIGGS (University of Southern California, Los Angeles.) *In* AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 8 p Dec. 1985

Avail: NTIS HC A07/MF A01

The Naval Aerospace Medical Research Laboratory (NAMRL) Vision Test Battery provides assessment of various visual functions, including spot detection, acuity at high and low contrast, glare sensitivity, and accommodative flexibility. Within these tests are measures of threshold, threshold-stressed response time (for near-threshold stimuli), and unconfounded response time (for supra-threshold stimuli). The contribution of response time variables to predicting flight performance was evaluated for 73 fighter pilots. Vision test data were compared to performance in air combat maneuver training. The distance (slant range) between the observer and target aircraft at time of initial visual detection was used as the performance variable. Availability of response time variables enhanced the ability to predict the air-to-air visual target detection performance of these pilots. Four vision variables accounted for about 32% of the variance in performance of those pilots who detected target aircraft at slant ranges greater than the group average. Prediction of performance is improved by incorporating other vision data and additional refinement of the performance measure. Author

N86-30322# Hopital d'Instruction des Armees, Paris (France). **THE VERTEBRAL COLUMN: SELECTION AND APTITUDE OF COMBAT AIRCRAFT PILOTS OF THE FUTURE [COLONNE VERTEBRALE: SELECTION ET APTITUDE DES PILOTES D'AVION DE COMBAT DU FUTUR]**

P. J. METGES, J. FLAGEAT, R. AUFRET, R. P. DELAHAYE, and H. VIEILLEFOND *In* AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 3 p Dec. 1985 *In* FRENCH

Avail: NTIS HC A07/MF A01

The new generation of combat aircraft is characterized by the possibility of negative effects on the vertebral column due to extended or peak acceleration forces. In order to provide the pilot with optimal capacity for visual information assimilation, the cervical rachis must remain mobile and is therefore vulnerable under certain circumstances. Lesions may occur in this area during flight. Prevention of this condition is based on three elements: extensive

radiological examination of the rachis for pilot applicants; technical improvements in helmet alignment; and physical adaptation training. B.G.

N86-30323# Militair Hospitaal Dr. A. Mathijssen, Utrecht (Netherlands).

SYSTEMATIC RADIOGRAPHIC EXAMINATION OF THE SPINE FOR SELECTION OF F-16 PILOTS: A PRELIMINARY REPORT
A. VANDALEN and H. H. M. VANDENBIGGELAAR (Royal Netherlands Air Force, Soesterberg.) /In AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 4 p Dec. 1985

Avail: NTIS HC A07/MF A01

With the introduction of the high performance aircraft F-16 in the Royal Netherlands Air Force an increase in spinal column disorders was anticipated. Therefore, a systematic whole spine radiography of candidate student pilots (CSPs) and qualified pilots (QPs) designated to fly F-16 were performed since December 1982. To reduce radiation exposure radiographs were made using a modern 14 inch intensifier. So far, 225 CSPs and 196 QPs were examined. Strict application of the medical criteria leads to a rejection of 20% of the CSPs because of spinal disorders visualized on X-ray. For F-16 pilots, the major region of interest seems to be the cervical spine. The rejection rate could be reduced by readjustment of the medical criteria and separate selection of helicopter and fighter pilots. Systematic examination of QPs who had no or incomplete previous examinations uncovers a high rate of spinal disorders. In the series QPs without any symptoms were only rejected because of cervical discopathy with osteophyte formation on the backside of the vertebrae and resulting narrowing of the spinal canal. Author

N86-30324# CEAM, Mont-de-Marsan (France).

PHYSICAL TRAINING OF MIRAGE 2000 PILOTS [ENTRAÎNEMENT PHYSIQUE DES PILOTES DE MIRAGE 2000]
G. POYOT, J. M. CLERE, J. LEMOT, and J. P. DELATTRE /In AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 5 p Dec. 1985 In FRENCH
Avail: NTIS HC A07/MF A01

Nine combat aircraft pilots underwent physical training specifically designed to increase their tolerance to acceleration forces. The suitability of the training was studied using centrifuge tests. The increase in tolerance could be attributed to the effects of the physical training or to an adaptation to the centrifuge. It is shown that together with an excellent original physical condition, specific physical training may increase the tolerance of acceleration forces. Further testing of this is expected. B.G.

N86-30325# Belgian Air Force, Brussels.

TREADMILL SPIROERGOMETRY IN THE SELECTION AND SCREENING OF HIGH-PERFORMANCE COMBAT AIRCRAFT PILOTS IN THE BELIGAN AIR FORCE [SPIROERGOMETRIE SUR TAPIS ROULANT DANS LA SELECTION ET LA SURVEILLANCE DES PILOTES D'AVIONS A HAUTES PERFORMANCES DE LA FORCE AERIENNE BELGE]

G. PIRQUIN, J. VASTESAAGER, and P. VANDENBOSCH /In AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 5 p Dec. 1985 In FRENCH
Avail: NTIS HC A07/MF A01

All pilots of the Belgian Air Force who were designated for conversion to the F-16 aircraft underwent cardiovascular and respiratory examinations. One of the tests was a test for maximum treadmill effort. In the first study, the results of the screening were combined with the results of tests conducted on a group of young candidate student pilots. The aerobic capacity of this population was then evaluated. The test sample included 156 persons of various ages and in different stages of physical conditioning. In the second study, the positive effects of physical training on the treadmill spiroergometric examination of a group of F-16 pilots were examined. B.G.

N86-30326# Naval Aerospace Medical Research Lab., Pensacola, Fla.

RELATIONSHIP OF CARDIOPULMONARY FITNESS TO FLIGHT PERFORMANCE IN TACTICAL AVIATION

G. R. BANTA and J. D. GRISSETT /In AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 11 p Dec. 1985

Avail: NTIS HC A07/MF A01

Current endeavors to identify whether cardiopulmonary fitness can positively influence flight performance in a tactical fighter community are discussed. Population analyses of experienced and student Naval aviators present evidence that the U. S. Navy aviation pilot community is in an above the average state of physical fitness with less than average coronary heart disease potential. Correlations found between cardiopulmonary fitness and psychophysiological responses that occur during simulated and/or actual flight operations present strong evidence that flight performance could be favorably affected. Author

N86-30327# Naval Aerospace Medical Inst., Pensacola, Fla. Aviation Physiology Dept.

HYPOBARIC TRAINING OF FLIGHT PERSONNEL WITHOUT COMPROMISING QUALITY OF LIFE

D. M. HERRON /In AGARD Medical Selection and Physiological Training of Future Fighter Aircrew 7 p Dec. 1985

Avail: NTIS HC A07/MF A01

The increased incidence in decompression sickness during physiology training among U. S. Navy aircrew personnel and medical attendants requires a search for alternative means of permitting recognition and corrective action of hypoxia. The requirement for individual hypoxia training is considered valid not just by Navy regulations but by aeromedical practioners throughout the world. A proposal is made to utilize a gas mixture consisting of 7.4% oxygen and 92.6% nitrogen to induce hypoxia at ground level. This would permit ground level hypoxia training with similar symptoms of hypoxia as presently demonstrated at 25,000 feet in a decompression chamber but would alleviate the primary cause of decompression sickness. All other U. S. Navy training objectives for the chamber exposure would be safely met and more efficiently demonstrated. The initial financial burden in modifying the existing decompression training chamber would be moderate when considering development and manufacturing of a new training device. The ultimate gain exists in decreased human suffering and the necessary return of credibility to the aeromedical training community. This is a must if we are to profess to do no harm. Author

N86-31210# Systems Research Labs., Inc., Dayton, Ohio.

THE EFFECT OF BREATHING ELEVATED CO₂ GAS MIXTURES ON TRACKING PERFORMANCE, BLOOD PRESSURE, AND SUBJECTIVE TOLERANCE AT 1GZ

T. G. SHRIVER, D. W. REPPERGER, J. W. FRAZIER, C. D. GOODYEAR, and L. D. TRIPP Mar. 1986 52 p
(Contract F33615-81-C-0500)

(AD-A165974; AAMRL-TR-86-006) Avail: NTIS HC A04/MF A01 CSCL 06S

The addition of small concentrations (5-10%) of carbon dioxide (CO₂) to the breathing gas has been identified as a possible technique to increase Gz tolerance for pilots. Eight subjects participated in an experiment to examine tracking performance, physiological parameters, and subjective tolerance when breathing the four following gas mixtures: air; 100% O₂; 2.5% CO₂ and 97.5% O₂; and 3.5% CO₂ and 96.5% O₂. Tracking performance was not significantly different when breathing any of these four gas mixtures. Learning, which continued to occur throughout the experiment, was inhibited when the subjects were breathing the 3.5% CO₂ mixture. When using either of the CO₂ mixtures there was a significant increase in relative respiratory volume and a modest increase in systolic (11 mm Hg) and diastolic (6 mm Hg) blood pressure. One subject, when breathing 3.5% CO₂, aborted the run after 12 minutes because of air hunger. GRA

N86-31211# Army Research Inst. of Environmental Medicine, Natick, Mass.

METABOLIC CHANGES FOLLOWING ECCENTRIC EXERCISE IN TRAINED AND UNTRAINED MEN

W. J. EVANS, C. N. MEREDITH, J. G. CANNON, C. A. DINARELLO, and W. R. FRONTERA 1986 24 p
(AD-A166521; AD-E900544; USARIEM-M-20/86) Avail: NTIS HC A02/MF A01 CSCL 06P

The effects of one 45 minute bout of high intensity eccentric exercise (250 Watts) were studied in 4 male runners and 5 untrained men. Plasma creatine kinase (CK) activity in these runners was high ($p < 0.001$) than in the untrained men before exercise and peaked at 207 IU/ml one day after exercise, while in untrained men the maximum was 2143 IU/ml five days after exercise. Plasma interleukin-1 (IL-1) in the trained men was also higher ($p < 0.001$) than in the untrained men before exercise but did not significantly increase after exercise. In the untrained men, IL-1 was significantly elevated 3 hours after exercise ($p < 0.001$). In the untrained group only, 24-hour urines were collected before and after exercise while the men consumed a meat-free diet. Urinary 3-methyl-histidine/creatinine in the untrained group rose significantly from 126 $\mu\text{mol/g}$ before exercise to 180 $\mu\text{mol/g}$ ten days after exercise. The results suggest that in untrained men, eccentric exercise leads to a metabolic response indicative of delayed muscle damage. Regularly performed long distance running was associated with chronically elevated plasma IL-1 levels and serum CK activities without acute increases after an eccentric exercise bout. GRA

N86-31212# Army Research Inst. of Environmental Medicine, Natick, Mass.

INDUCED ERYTHROCYTHEMIA AND MAXIMAL AEROBIC POWER: AN EXAMINATION OF MODIFYING FACTORS

M. N. SAWKA, A. J. YOUNG, S. R. MUZA, R. R. GONZALEZ, and K. B. PANDOLF Apr. 1986 23 p
(AD-A166522; AD-E900544; USARIEM-M-22/86) Avail: NTIS HC A02/MF A01 CSCL 06E

Induced erythrocythemia is associated with an increase in maximal oxygen uptake. Two factors which might influence inter-subject variability for this increase in maximal oxygen uptake are the magnitude of change in hemoglobin concentration and the individual's initial aerobic fitness. To examine these factors, we have obtained and combined individual data from our own research and three other studies which employed similar procedures. In each study freeze-preserved erythrocytes representing the product of two blood units were reinfused and maximal oxygen uptake was measured within 24 to 72-h after reinfusion. The 30 subjects had an initial aerobic power which ranged from 36 to 88 ml O₂/kg/min. The combined results from these studies indicate that after erythrocyte reinfusion: 1) the increase in hemoglobin concentration is fairly homogeneous; 2) nearly all individuals demonstrate an increase in maximal oxygen uptake; 3) the magnitude of increase in hemoglobin concentration is not related to the magnitude of increase in maximal oxygen uptake is related to the individual's initial aerobic fitness. Individuals with an initial aerobic fitness between 50 to 64 ml O₂/kg/min experience approximately twice the increase in maximal oxygen uptake after erythrocyte reinfusion compared to individuals with lesser or greater fitness. GRA

N86-31213# Army Research Inst. of Environmental Medicine, Natick, Mass.

INTRINSIC ALTERATION OF THE REACTIVE PROPERTIES OF ARTERIES DURING HYPOTHERMIA

N. R. BANDICK and D. E. ROBERTS 21 Mar. 1986 23 p
(AD-A166523; AD-E900544; USARIEM-M-21/86) Avail: NTIS HC A02/MF A01 CSCL 06E

This study compared the reactive and contractile properties of helical strips of femoral arteries taken from normothermic rabbits and rabbits that were anesthetized with pentobarbital and cooled to 25 C at a rate of 7 C per hour. The purpose of this comparison was to see if intrinsic factors would alter the sensitivity and/or contractility of this vascular muscle to norepinephrine during whole

body hypothermia. We found that, after two hours of in vivo hypothermia, the hypothermic derived tissue was from 10 to 100 times more sensitive to norepinephrine than the normothermic derived tissue. This augmented sensitivity continued while the tissue was in vitro for at least twelve hours. The dose-response curves of the hypothermic derived arteries were shifted to the left of the normothermic arteries resulting in a greater contractility at lower levels of agonist. Moreover, the normothermic tissue contracted slower than the hypothermic. The maximal tension developed by the strips was equivalent. This study has identified prolonged alterations of receptor sensitivities and contractility properties attributable to in vivo influences that can, in part, explain the disruptions of blood pressure during and following whole body hypothermia. GRA

N86-31214# Air Force Occupational and Environmental Health Lab., Brooks AFB, Tex.

ASSESSING POSSIBLE DAMAGE DUE TO RADIO FREQUENCY RADIATION Final Report

B. J. POITRAST Feb. 1986 13 p
(AD-A166913; OEHL-86-020C0111BRA) Avail: NTIS HC A02/MF A01 CSCL 06R

This report is written in response to requests from the field for guidance in the clinical examination of radio frequency radiation exposures. The report contains basic information on radio frequency radiation and its biological interactions. It also contains a suggested history and physical examination, a list of expected clinical findings, and suggestions for referral if necessary. GRA

N86-31215# Pacific Northwest Labs., Richland, Wash.

PHYSICAL INTERACTION OF HUMANS AND ANIMALS WITH POWER-FREQUENCY ELECTRIC AND MAGNETIC FIELDS

W. T. KAUNE Feb. 1986 11 p Presented at the IEEE Power Engineering Society Winter Meeting, New York, N.Y., 2 Feb. 1986 (Contract DE-AC06-76RL-01830)
(DE86-007734; PNL-SA-13716; CONF-860210-3) Avail: NTIS HC A02/MF A01

Research has been underway for more than 15 years investigating the biological and physical interactions of power-frequency electric fields coupled to humans and animals through the air dielectric around electric-power facilities. Currently, fairly detailed analyses can be made for homogeneous human- and animal-shaped models standing on ground while exposed to a vertical electric field. Some data are available for ungrounded exposure conditions. However, little is known about the effects of the nonuniform electrical properties of living tissues on induced-current distributions. Recently, interest has also developed in the interaction of humans and animals with power-frequency magnetic fields. Little data are available, and only simple estimates, using homogeneous ellipsoidal models, can be made at present. Relatively simple calculational techniques are available, however, to analyze two- and three-dimensional models of humans and animals, and it can be expected that considerable progress will be made in the next few years. DOE

N86-31426*# Texas A&M Univ., College Station. Dept. of Biomedical Engineering.

ANALYSIS OF NYSTAGMUS RESPONSE TO A PSEUDORANDOM VELOCITY INPUT

C. S. LESSARD /in NASA. Johnson Space Center NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1985 104 p Jul. 1986
Avail: NTIS HC A99/MF E03 CSCL 06P

Space motion sickness was not reported during the first Apollo missions; however, since Apollo 8 through the current Shuttle and Skylab missions, approximately 50% of the crewmembers have experienced instances of space motion sickness. Space motion sickness, renamed space adaptation syndrome, occurs primarily during the initial period of a mission until habitation takes place. One of NASA's efforts to resolve the space adaptation syndrome is to model the individual's vestibular response for basis knowledge and as a possible predictor of an individual's susceptibility to the disorder. This report describes a method to analyse the vestibular

system when subjected to a pseudorandom angular velocity input. A sum of sinusoids (pseudorandom) input lends itself to analysis by linear frequency methods. Resultant horizontal ocular movements were digitized, filtered and transformed into the frequency domain. Programs were developed and evaluated to obtain the (1) auto spectra of input stimulus and resultant ocular response, (2) cross spectra, (3) the estimated vestibular-ocular system transfer function gain and phase, and (4) coherence function between stimulus and response functions. Author

N86-31428*# Texas Univ., Galveston. Dept. of Internal Medicine.

FLOW CYTOMETRY ANALYSIS OF HORMONE RECEPTORS ON HUMAN PERIPHERAL BLOOD MONONUCLEAR CELLS TO IDENTIFY STRESS-INDUCED NEUROENDOCRINE EFFECTS

R. T. MEEHAN /n NASA. Johnson Space Center NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1985 7 p Jul. 1986
 Avail: NTIS HC A99/MF E03 CSCL 06P

Understanding the role of circulating peptide hormones in the pathogenesis of space-flight induced disorders would be greatly facilitated by a method which monitors chronic levels of hormones and their effects upon in vivo cell physiology. Single and simultaneous multiparameter flow cytometry analysis was employed to identify subpopulations of mononuclear cells bearing receptors for ACTH, Endorphin, and Somatomedin-C using monoclonal antibodies and monospecific antisera with indirect immunofluorescence. Blood samples were obtained from normal donors and subjects participating in decompression chamber studies (acute stress), medical student academic examination (chronic stress), and a drug study (Dexamethasone). Preliminary results indicate most ACTH and Endorphin receptor positive cells are monocytes and B-cells, exhibit little diurnal variation but the relative percentages of receptor positive cells are influenced by exposure to various stressors and ACTH inhibition. This study demonstrates the capability of flow cytometry analysis to study cell surface hormone receptor regulation which should allow insight into neuroendocrine modulation of the immune and other cellular systems during exposure to stress or microgravity.

53

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A86-43535#

DETECTION OF SYSTEM FAILURE BY HUMAN OPERATOR. I - THE CASE OF MONITOR

N. YUHARA and S. HORIUCHI Japan Society for Aeronautical and Space Sciences, Journal (ISSN 0021-4663), vol. 34, April 1986, p. 199-210. In Japanese, with abstract in English. refs

Two models describing human monitoring behavior in failure detection are proposed. The first model consists of two linear optimal estimators (Kalman filters), and the failure detection mechanism is based on Wald's Sequential Probability Ratio Test (SPRT). The two models' performances are validated in the comparison of digital simulation results of failure detection time and accuracy with data obtained from a set of failure detection experiments. R.R.

A86-43539#

REVIEW ON SECONDARY TASK TECHNIQUE FOR WORKLOAD ASSESSMENT SOME CONSIDERATION OF SECONDARY TASK PARADIGMS AND AN ASSESSMENT MODEL

T. YAMAGUCHI (Nihon University, Tokyo, Japan) and Y. NAGASAWA (Japan Air Self Defense Force, Aeromedical Laboratory, Tokyo) Japan Air Self Defence Force, Aeromedical Laboratory, Reports (ISSN 0023-2858), vol. 26, Dec. 1985, p. 159-168. In Japanese, with abstract in English. refs

The secondary task technique is reviewed, technical terms are defined, and a novel measuring paradigm is proposed. This novel paradigm (the dual task paradigm) involves a situation whereby the primary and secondary tasks are performed concurrently; both tasks are considered to be of equal importance and the operator is instructed to perform the two tasks with maximum effort. In effect, emphasis is placed on the maximum channel capacity in which the operator can perform two tasks concurrently. The inherent advantage of this dual task technique lies in the ability to evaluate the operator's workload using a workload index based on the maximum channel capacity and a time based model.

K.K.

A86-44601

THEORETICAL PRINCIPLES UNDERLYING THE EVALUATION, CONTROL, AND CORRECTION OF THE IMPACT OF EMOTIONS ON COSMONAUT ACTIVITY [TEORETICHESKIE OSNOVY OTSENKI, METODOV KONTROLIA I KORREKTSII VLIANIYA EMOTSII NA DEIATEL'NOST' KOSMONAVTA]

P. V. SIMONOV (AN SSSR, Institut Vyshei Nervnoi Deiatel'nosti i Neurofizologii, Moscow, USSR) Uspekhi Fiziologicheskikh Nauk (ISSN 0301-1798), vol. 17, Apr.-June 1986, p. 20-30. In Russian. refs

The genesis of the emotional stress arising in cosmonauts during space flights is discussed in the framework of Lebedev's (1980) information theory of emotions, which places emphasis on the effects of complete information or the lack of it on the emotional status of the cosmonaut. Among the psychophysiological methods recommended for dynamic evaluation of the pilot's emotional status, the monitoring of involuntary physiological functions, such as the heart rate, eyelid movements, and the acoustic speech parameters, are of primary importance. As the best measure against neuroemotional stress, it is recommended that the pilot be independent of ground-based command and confirmation. The cosmonauts should be given thorough training in a great variety of practical skills needed in regular flight and in every foreseeable emergency situation. I.S.

A86-45955

ENHANCED DETECTION IN THE APERTURE OF FOCAL ATTENTION DURING SIMPLE DISCRIMINATION TASKS

D. SAGI (Weizmann Institute of Science, Rehovot, Israel) and B. JULESZ (AT&T Bell Laboratories, Murray Hill, NJ) Nature (ISSN 0028-0836), vol. 321, June 12, 1986, p. 693-695.

It is considered whether attention directed toward a specific position in the visual field for an orientation discrimination task improves performance on a simple detection tasks in the area to which attention is directed. It is found that a small test flash can be detected when it is positioned near a peripheral line target presented briefly, if the orientation of the target has to be identified. The test flash cannot be detected when presented at some distance from the same target or when another target has to be identified. This enhancement implies that even simple identification takes such as orientation discrimination are not performed passively by the visual system. C.D.

N86-30328* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DIVISION OF ATTENTION AS A FUNCTION OF THE NUMBER OF STEPS, VISUAL SHIFTS, AND MEMORY LOAD

R. A. CHECHILE (Tufts Univ., Medford, Mass.), K. BUTLER, W. GUTOWSKI, and E. A. PALMER 1986 11 p

(Contract NCA2-OR785-801)

(NASA-TM-88775; NAS 1.15:88775) Avail: NTIS HC A02/MF A01

The effects on divided attention of visual shifts and long-term memory retrieval during a monitoring task are considered. A concurrent vigilance task was standardized under all experimental conditions. The results show that subjects can perform nearly perfectly on all of the time-shared tasks if long-term memory retrieval is not required for monitoring. With the requirement of memory retrieval, however, there was a large decrease in accuracy for all of the time-shared activities. It was concluded that the attentional demand of long-term memory retrieval is appreciable (even for a well-learned motor sequence), and thus memory retrieval results in a sizable reduction in the capability of subjects to divide their attention. A selected bibliography on the divided attention literature is provided. Author

N86-30329# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

THE EFFECT OF SPECTRALLY SELECTIVE FILTERS ON VISUAL SEARCH PERFORMANCE Final Report

G. T. CHISUM, J. B. SHEEHY, P. E. MORWAY, and G. K. ASKEW 8 Aug. 1985 17 p

(AD-A165835; NADC-85115-60) Avail: NTIS HC A02/MF A01 CSCL 06P

The effect of five spectrally selective filters on the performance of an acuity dependent visual search task was evaluated. The filters were: (A)a neutral density filter (control condition); (B)a 52 00A green interference filter; (C)a 3215-250 red filter; (D)a neodymium visor; and (E)a holographic filter. The observers were presented with five blocks of ten slides per filter. Each slide projected a 6 by 6 deg field of 900 ten min of arc letter Os which contained a single Landolt C. The observers were required to search the field and report the orientation of the opening in the C. The opening in the C, which subtended 2.64 min of arc, required an acuity of 0.39 for detection. Response time, error rate, accommodative accuracy, and the number of fixations and their duration were recorded for each slide presentation. The results demonstrate that filter type had no effect on any of the response measures. During the first three trial blocks the observers appeared to optimize their search strategies, after which they began to revert to their initial performance levels. Although this effect was not supported statistically, this trend indicates that initially search proficiency increases with practice after which it is offset by fatigue. GRA

N86-30330# Pittsburgh Univ., Pa. Psychiatric Inst. and Clinic. **THE IMPORTANCE OF SPECIALIZED COGNITIVE FUNCTION IN THE SELECTION OF MILITARY PILOTS**

H. W. GORDON and R. LEIGHTY 19 Mar. 1986 43 p

(Contract N00014-83-K-0208)

(AD-A165889) Avail: NTIS HC A03/MF A01 CSCL 05J

Visuospatial skills significantly distinguished student Naval aviators who dropped out of aviation training from those who received their wings. While both groups were better than average on these tests, the winged aviators were better than the dropout group by 0.25 standard deviation which is highly significant ($P < 0.0001$) for the total sample of 600 subjects. Performance on verbal-sequential skills did not distinguish between the groups. Logistic regression not only confirmed the group difference but demonstrated an interaction with verbal-sequential skills. High performance on these skills helped the odds of being winged for aviators with low visuospatial ability but hindered those with high visuospatial ability. Distribution of visuospatial scores for the 2 groups demonstrated reasonable cut-off points at which considerably more drop-outs than winged aviators could have been eliminated. However, these data are relevant only for the selected

sample of aviators accepted for the training programs. An additional study on the entire group of applicants including those rejected would allow comparison between the special cognitive tests used in this study and those already used as selection criteria. GRA

N86-30331# SRI International Corp., Menlo Park, Calif.

SPATIOTEMPORAL CHARACTERISTICS OF VISUAL LOCALIZATION Final Report, 1 Jun. 1982 - 31 Aug. 1985

C. A. BURBECK 30 Oct. 1985 21 p

(Contract F49620-82-K-0024)

(AD-A166097; AFOSR-86-0109TR) Avail: NTIS HC A02/MF A01 CSCL 20F

The main thrust of this research effort has been investigation of the spatial and temporal properties of the visual processes underlying relative spatial localization by human observers. The initial tasks were development of a suitable laboratory display system for generating the required stimuli, and development of appropriate experimental paradigms for studying the localization of widely separated objects. The second task was to make careful quantitative measurements of the spatial and temporal properties of the system underlying localization of widely separated objects. It was found that many of the stimulus manipulations that are critical in determination of contrast detection thresholds have little or no effect on localization accuracy. The relative localization of widely separated objects is a highly robust visual ability. Those variations in localization accuracy with changes in the spatial and temporal parameters of the stimulus that were obtained could readily be modeled as natural extensions of the threshold properties. The final task of this project was testing of existing models of spatial ability that can be accounted for by current models of spatial vision. Specific extensions of the existing model were suggested by the data. GRA

N86-30332# Nova Technical, Inc., Tarzana, Calif.

AN INVESTIGATION OF THE USE OF STEADY-STATE EVOKED POTENTIALS FOR HUMAN PERFORMANCE AND WORKLOAD ASSESSMENT AND CONTROL Final Technical Report, 15 Jun. 1983 - 14 Jun. 1985

S. L. MOISE, JR. Jun. 1985 66 p

(Contract F49620-83-C-0102)

(AD-A166205; AFOSR-86-0110TR) Avail: NTIS HC A04/MF A01 CSCL 05J

This program of research investigated Steady-State Evoked Potential (SSEP) measures to determine their utility for evaluating sensory inputs, workload, and performance variables in human operators. A primary purpose was to find techniques and measures that could be generalized to groups of subjects in operational environments. SSEP measures included power (amplitude), coherence, phase lag, and Relative Transmission Time (RTT). Included in this effort were studies of: (1) Frequency masking, where multiple frequencies were presented simultaneously. (2) Sensory inputs which may manipulate SSEP (e.g., color, intensity, cross-modality stimulation). (3) Correlation of SSEP measures with fatigue and task difficulty. (4) The relationship between performance in a tracking task and SSEP measures. GRA

N86-30333# New York Univ. Medical Center.

NOVEL ARCHITECTURES FOR IMAGE PROCESSING BASED ON COMPUTER SIMULATION AND PSYCHOPHYSICAL STUDIES OF HUMAN VISUAL CORTEX Final Report, 15 Apr. 1983 - 15 Apr. 1985

E. L. SCHWARTZ 2 Jan. 1986 96 p

(Contract F49620-83-C-0108)

(AD-A166222; AFOSR-86-0059TR) Avail: NTIS HC A05/MF A01 CSCL 05J

This final report consists of two parts. The first part is a computer simulation of the functional architecture of the visual cortex, and an examination of the possible significance that this architecture may have for understanding both human visual computation and machine vision. The second part of this report is a psychophysical investigation of human shape perception in terms of boundary descriptors of curvature. GRA

N86-30334# Naval Submarine Medical Research Lab., Groton, Conn.

THE EFFECTS OF COLOR-CODING IN GEOSIT (GEOGRAPHICAL SITUATIONAL) DISPLAYS. 2: REDUNDANT VERSUS NON-REDUNDANT COLOR-CODING Interim Report

A. R. JACOBSEN, W. H. ROGERS, and D. F. NERI 15 Jan. 1986 26 p
(AD-A166263; NSMRL-1069-2) Avail: NTIS HC A03/MF A01 CSCL 05H

The effect on search time of redundant versus non-redundant color-coding of symbols in geographical situational (GEOSIT) displays was evaluated using 36 observers who were randomly assigned to three coding schemes: monochrome-coding, redundant color-coding, and non-redundant color-coding. In the color-coding schemes, only the threat information (Friendly, Unknown, and Hostile) was color coded, either redundantly with shape or not. The platform information (Submerged, Surface, and Airborne) was coded by shape in all three coding schemes. Performance when searching for the color-coded threat target categories was enhanced by over 100% compared to monochrome shape-coding. In addition, response time on the non-color-coded platform categories was significantly faster under the non-redundant color-coding scheme than under the redundant color-coding scheme.

Author (GRA)

N86-30335# Institute for Perception Research, Eindhoven (Netherlands).

ACTIVITIES REPORT IN PERCEPTION RESEARCH Annual Report, 1984

1985 161 p
(IPO-19-1984; ESA-86-97398) Avail: NTIS HC A08/MF A01

Research concerning hearing and speech; vision and reading; cognition and communication; information ergonomics; communication aids for the handicapped; and perception studies instrumentation and software is summarized. ESA

N86-30336# Institute for Perception RVO-TNO, Soesterberg (Netherlands). Cognitive Psychology Group.

COGNITIVE ASPECTS OF COMMAND AND CONTROL

G. KEREN and J. G. W. RAAIJMAKERS Jan. 1986 45 p
(IZF-1986-2; TDCK-86-0580; ESA-86-97399) Avail: NTIS HC A03/MF A01

Topics and specific studies within cognitive sciences that have direct relevance to the functioning of a C3 unit are reviewed. Issues related to the manner in which information is obtained and processed, and the different aspects that are related to the decision process are discussed. Research subjects on command and control systems are suggested. ESA

N86-30337# Institute for Perception RVO-TNO, Soesterberg (Netherlands). Human Performance Group.

ATTENTION TASKS AND THEIR RELATION TO AGING AND FLIGHT EXPERIENCE

L. C. BOER Feb. 1986 28 p
(Contract A83/KLU/078)
(IZF-1986-4; TDCK-86-0585; ESA-86-97400) Avail: NTIS HC A03/MF A01

The Dichotic Listening Task (DLT) of Gopher and Kahneman (1971) was studied in a group of 143 aviators, aged between 17 and 70 yr. Other tasks of the study were the Continuous Memory Task (CMT) and two choice-RT tasks with visual stimuli. An attention questionnaire was also administered. Aging has negative effects on all tasks, especially on the DLT. With age factored out, no substantial correlations between DLT and other tasks are found. The only exception is a moderate correlation with choice RT. Differences between subgroups of aviators (42 airline pilots and 50 private pilots) were studied. The assumption was that airline pilots had higher levels of aviator skill. The DLT, CMT, and one of the RT tasks correlate with aviator subgroup. A second study with 16 flight cadets finds significant correlations between DLT and RT tasks on the one hand, and pilot gradings obtained later. It is concluded that DLT and RT tasks offer prospects for improving the selection of aviators. ESA

N86-31216# California Univ., Los Angeles. Medical Center. **NEUROPHYSIOLOGICAL RESEARCH SUPPORTING THE INVESTIGATION OF ADAPTIVE NETWORK ARCHITECTURES**

Final Report, 1 Mar. 1983 - 28 Feb. 1985

C. D. WOODY 14 Aug. 1985 90 p
(Contract F49620-83-C-0077)
(AD-A166074; AFOSR-86-0083TR) Avail: NTIS HC A05/MF A01 CSCL 06P

The investigators have shown that single cortical neurons adapt in such a way as to support learned behavior. What is particularly interesting is the indication that purposefully complex, molecular cascades exist at the level of single nerve cells to permit successful adaptations to occur. Successful adaptations are defined as: (a) producing the desired alteration of response to the appropriate input, (b) enduring over time, (c) not interfering with other adaptations occurring for another purpose in the same cell, and (d) not interfering with the main-throughput-message transfer property of the nerve cell. The result of these adaptations is to support the operation of a self-organizing information processing system with a high success: error ratio and excellent survivability in the face of substantial environmental change. Changes in the excitability of cortical neurons occur that lead to acquisition of the ability to perform specific motor tasks in response to specific auditory stimuli. Rates of acquiring this ability can be substantially increased by adding electrical stimulation of the hypothalamus associatively, to presentations of conventional conditioned and unconditioned stimuli. Part of this acceleration of learning the motor response may derive from recruitment of a new performance pathway-reflected in a longer transmission latency for movement production. A long range goal of the research is to understand how the system picks the right pathway. GRA

N86-31217# Northwestern Univ., Evanston, Ill. Vision Lab. **SENSITIVITY TO VISUAL MOTION IN STATISTICALLY DEFINED DISPLAYS Final Report, Nov. 1981 - Nov. 1982**

R. W. SEKULER, D. W. WILLIAMS, and S. A. HARP Mar. 1986 148 p
(Contract MDA903-80-C-0154; DA PROJ. 2Q1-61102-B-74-F)
(AD-A167291; ARI-RN-86-30) Avail: NTIS HC A07/MF A01 CSCL 05J

This project explored aspects of how human observers perceive moving targets, particularly targets whose motion is apparent rather than continuous. Major topics covered include origins of global motion Percepts, and size factors in apparent motion. GRA

54

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A86-44094

AIR AMBULANCE REGULATIONS - A MODEL

F. THOMAS, H. GIBBONS, and T. P. CLEMMER (LDS Hospital; Salt Lake County, Dept. of Health; Utah, University, Salt Lake City) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 57, July 1986, p. 699-705. refs

Prior attempts at establishing minimal federal air ambulance regulations and standards have been unsuccessful. However, reports of poor patient medical care during transport by some air ambulance services is now forcing many states to initiate air ambulance regulations. In 1984, the State of Utah Emergency Medical Services convened a special subcommittee to develop aeromedical regulations for the State of Utah. Using a three-level approach based upon the patient's requirements for basic, advanced, or specialized medical care and the urgency of transport, the subcommittee was able to derive medical categories necessary for the selection and utilization of air ambulance services. Minimum

air ambulance regulations were then established for aircraft configuration, flight crew requirements, minimal equipment and medications, and the responsibilities of the medical director or designee for each of the three levels of medical care. It is concluded that the application of a levels approach based upon the patient's medical requirements may be useful in assisting other states attempting to establish flexible but specific regulations directed at the safe transport of patients by aeromedical evacuation. Author

A86-44532

INTELLIGENT CREW WORKSTATIONS

D. STANLEY, R. WORDEN, and R. RIVERS (Logica UK, Ltd., Cambridge, England) IN: Space - Technology and opportunity; Proceedings of the Conference, Geneva, Switzerland, May 28-30, 1985. Pinner, England, Online Publications, 1985, p. 69-80.

A preliminary framework for analysis of crew workstation user interface issues is presented. The Framework attempts to map factors relating to individual users, the space station environment, tasks and the particular 'states' of the Space Station onto desirable user interface characteristics. Factors relating to the individual are discussed with respect to the provision of an adaptable user interface through the use of 'user models' derived from an intelligent training environment. Author

A86-44534

ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEMS

K. THORMER (Dornier System GmbH, Friedrichshafen, West Germany) IN: Space - Technology and opportunity; Proceedings of the Conference, Geneva, Switzerland, May 28-30, 1985. Pinner, England, Online Publications, 1985, p. 91-100. refs

The design of the life support and environmental control systems (ECLSS) for the ESA Columbus module of the Manned Space Station (MSS) is proceeding mainly on the basis of experience with Spacelab. One deviation will be recycle waste water and breathing air wherever possible to avoid transportation costs, closing the on-board loop where possible. CO₂ will, however, initially have to be removed from the air, probably with LiOH cartridges that will be returned to earth when the cartridges reach capacity. A solid amine CO₂ regenerator is being studied to eliminate the cartridges. Subsequent evolutions will move toward closing the loop with electrolytic oxygen generation, probably with water vapor electrolysis. Reliable removal of air contaminants will require basic research in the technology. A block diagram is provided of the proposed ECLSS design. M.S.K.

A86-44779

THE TECHNOLOGY IMPACT OF THE ADVANCED TECHNOLOGY CREW PROTECTION (ATCP) SYSTEM ON HIGH PERFORMANCE AIRCRAFT

K. K. ALEXANDER (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH), T. A. HENNEMAN, and S. A. THOMPSON (Northrop Corp., Aircraft Div., Hawthorne, CA) SAFE Journal, vol. 16, no. 2, Summer 1986, p. 22-27. (Contract F33615-84-C-3407)

A description of the Advanced Technology Crew Protection (ATCP) system, integrating many cockpit functions and components directly into the crewman's flight garment, and including a 57-degree semisupine seat and aircraft mounted ancillary equipment, and its potential impact on future fighter aircraft performance, are presented. The system is capable of protecting against high g forces, high q forces, high altitudes, Nuclear Biological Chemical threats, and High Energy fragments, and it provides all-axis restraint, closed-loop cooling, and breathing assistance. Emergency subsystems will enable critical autonomous operational capability, and the ATCP will provide get-me-down capability or post-ejection survival protection. Crewmember stress and fatigue is expected to be lowered, and, for the aircraft studied, it is expected that the ATCP will provide increase altitude capability, lower drag, and very high-g capability. R.R.

A86-45014

PREFERRED DECLINATION OF THE LINE OF SIGHT

S. G. HILL and K. H. E. KROEMER (Virginia Polytechnic Institute and State University, Blacksburg) Human Factors (ISSN 0018-7208), vol. 28, April 1986, p. 127-134. refs

This research concerned the angle at which people prefer to look down at visual targets and tasks. Thirty-two subjects participated in a study with four different head positions, two visual tasks, and two target distances. The overall preferred mean angle in the midsagittal plane below the Frankfurt Plane was -34 deg. Head position had significant effects on angle: subjects sitting with their heads upright preferred an average declination of -29 deg, but -40 deg when supine. Target distance also significantly affected the line-of-sight angle, with subjects preferring targets at 0.50 m to be at -38 deg, but targets at twice that distance at -30 deg. The task did not influence the preferred angle. Author

A86-45015

VISUAL ACCOMMODATION AND VIRTUAL IMAGE DISPLAYS - TARGET DETECTION AND RECOGNITION

J. NORMAN and S. EHRLICH (Haifa, University, Israel) Human Factors (ISSN 0018-7208), vol. 28, April 1986, p. 135-151. refs

Twelve subjects performed a complex task, detecting and recognizing small targets presented at infinity, while simultaneously monitoring a virtual image display (VID). The VID was presented at one of four optical distances (2.0, 0.5, 0.0, and -0.5 D). Optical distance was found to affect detection and recognition performance, mainly at the extreme value of 2.0 D. Interactions between optical distance and grouping of subjects according to measures of accommodation indicated that the three other optical distances affect performance differentially. The subjects' resting position of accommodation (RPA) and a combined measure of accommodation range and RPA were significantly correlated with performance (0.58). A narrowing of the functional visual field (complete misses of peripheral targets) was found at the 2.0-D optical distance for all subjects, and at the other optical distances for the subjects with an inferior accommodative mechanism (i.e., a near RPA and/or a narrow accommodation range). Author

A86-45073

METHODS OF MEASURING THE ATTENUATION OF HEARING PROTECTION DEVICES

E. H. BERGER (Cabot Corp., Indianapolis, IN) Acoustical Society of America, Journal (ISSN 0001-4966), vol. 79, June 1986, p. 1655-1687. refs

Hearing protection device (HPD) attenuation evaluation methods are described. The insertion loss of an HPD is utilized to assess the reduction in sound pressure level (SPL) when HPDs are applied. The experimental conditions and procedures for three real-ear attenuation at threshold (REAT) techniques, nine above-threshold methods, and four objective methods of measuring hearing protection attenuation are examined. The accuracy, practicality, and applicability of the various techniques are analyzed. Measurements on linear and nonlinear HPDs and the potential level dependent effects are investigated. It is observed that the REAT method is the most accurate because it assesses all sound paths to the occluded ear. The data indicate that attenuation is independent of SPL for linear protectors and therefore the use of above-threshold procedures to evaluate attenuation is not required. It is detected that all objective procedures do not accurately evaluate the significance of the flanking-bone conduction paths; however, the acoustical test fixture technique is recommended based on quality control, time savings, and buyer acceptance testing. A microphone in real-ear approach is proposed for future attenuation evaluations. I.F.

A86-45117

EXPERIMENTAL ESTIMATE OF THE PARAMETERS OF A STOCHASTIC MODEL OF A HUMAN OPERATOR SENSOR SYSTEM

I. V. KUROCHKIN and A. A. MALTSEV Automation and Remote Control (ISSN 0005-1179), vol. 46, no. 12, May 10, 1986, pt. 1, p. 1547-1554. Translation. refs

A technique of estimation is proposed for the parameters of a stochastic adaptive model of the sensor system of a human operator (i.e., the perceived noise level, the time constant, and the signal-to-noise ratio). The experimental results are presented for various sensitivities of the indicator and the strength of the disturbances acting on the plant. The increase in the perceived noise in two-variable tracking is estimated in comparison to one-variable tracking. Author

A86-45692* Life Systems, Inc., Cleveland, Ohio.

ENVIRONMENTAL CONTROL/LIFE SUPPORT SYSTEM FOR SPACE STATION

C. W. MILLER, D. B. HEPPNER, F. H. SCHUBERT, and M. J. DAHLHAUSEN (Life Systems, Inc., Cleveland, OH) Earth-Oriented Applications of Space Technology (ISSN 0277-4488), vol. 6, no. 2, 1986, p. 213-229. Research supported by Life Systems, Inc., and NASA.

The functional, operational, and design load requirements for the Environmental Control/Life Support System (ECLSS) are described. The ECLSS is divided into two groups: (1) an atmosphere management group and (2) a water and waste management group. The interaction between the ECLSS and the Space Station Habitability System is examined. The cruciform baseline station design, the delta and big T module configuration, and the reference Space Station configuration are evaluated in terms of ECLSS requirements. The distribution of ECLSS equipment in a reference Space Station configuration is studied as a function of initial operating conditions and growth orbit capabilities. The benefits of water electrolysis as a Space Station utility are considered. I.F.

A86-46941#

ADVANCED SPACE SUIT DEVELOPMENT FOR FUTURE ON-ORBIT OPERATIONS

J. L. ZELON (ILC Space Systems, Houston, TX) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 8 p. refs

(AIAA PAPER 86-2310)

This paper describes the planned space suit developments for future on-orbit operations including Shuttle, Space Station and Transatmospheric based missions. The issues driving design changes in the current Shuttle EMU for Space Station are defined. In addition, advanced development programs underway by NASA in pressure suit closure design, joint technology and glove technology are identified. Author

A86-46942#

ZERO-G SIMULATION VERIFIES EVA SERVICING OF SPACE STATION MODULES

B. N. GRIFFIN (Boeing Aerospace Co., Huntsville, AL) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 6 p.

(AIAA PAPER 86-2312)

The Space Station accommodations required for on orbit zero-g maintenance and repair were evaluated during two months of neutral buoyancy testing. Boeing, in a joint effort with NASA, used Shuttle-type pressure suits and the simulated weightlessness provided by neutral buoyancy to assess four areas of hardware and operations. These included: (1) Space Station System Architecture; (2) Common Module Exterior; (3) Common Module Interior; and (4) Voice-Activated Systems. Specifically, the tests focused on servicing debris shield/body-mounted radiator panels, replacement of thermal blankets or Multi-Layer insulation and repair techniques for debris damage. Design engineers and astronauts participated as pressure-suited test subjects in evaluation of a broad range of concept options. The significant findings for these tests are: (1) the astronaut positioning arm is one of the most

useful tools for Space Station EVA operations; (2) the minimum separation between modules should be 78 inches; (3) axial debris panels were preferred over circumferential; (4) on-orbit repair techniques for debris-damaged modules were effective; and (5) voice-activated systems are ideal for EVA. Improved suit communications, however, are required for implementation.

Author

A86-46943*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

GROWTH EVOLUTION OF THE SPACE STATION ECLSS

W. R. HUMPHRIES (NASA, Marshall Space Flight Center, Huntsville, AL) and R. G. SOSNAY (Martin Marietta Aerospace, Denver, CO) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 10 p.

(AIAA PAPER 86-2313)

This paper discusses the planned evolution and growth of the Space Station ECLSS. It discusses the planning on-going at the early design stages to enable growth from a man-tended configuration of the Space Station (wherein the Space Station would be manned only when visited by the Orbiter) to a fully operational configuration (called Initial Operational Capability - IOC) which includes a permanently manned, fully operational Space Station. The paper then also discusses how the IOC Space Station ECLSS can evolve to account for increase in crew sizes, increase in the number of attached modules, increase in the capability to handle more payload/customer support, and potential evolution of the ECLSS technologies. Author

A86-46944#

IMPACT OF AUTOMATION ON SPACE STATION MMI DESIGN

P. G. JAMAR (Honeywell Systems and Research Center, Minneapolis, MN) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 5 p. refs

(AIAA PAPER 86-2316)

Space-based crews are expected to interact with highly automated and possibly intelligent systems, to perform these interactions with often little or no prior training, and to do so on an infrequent or sporadic basis. These activities will characterize a new role for space-based crews, that of supervisory control. Supervisory control tasks in turn define a new set of requirements for Space Station man-machine interface (MMI) design: (1) multi-function display and control hardware, (2) displays that enhance the crew person's 'mental model' of invisible processes, (3) highly supportive man-machine dialogue, including special features to support dialogue with expert systems, and (4) incorporation of machine intelligence into the MMI itself to provide a seemingly uniform interface to numerous processes, data bases, and expert systems. A discussion of these concepts is illustrated by examples from recent MMI designs, including a multi-function display and control system developed for the Space Shuttle, and MMI system developed for NASA JSC for the Space Station environmental control and life support system, and ATOZ - an intelligent interface system. Author

A86-46945*# Boeing Aerospace Co., Huntsville, Ala.

ADVANCED OPERATOR/SYSTEM INTERFACE CONCEPTS FOR THE SPACE STATION

C. M. CASE and P. S. Y. LIN (Boeing Aerospace Co., Huntsville, AL) AIAA, Space Station in the Twenty-first Century, Meeting, Reno, NV, Sept. 3-5, 1986. 8 p.

(Contract NAS8-36526)

(AIAA PAPER 86-2317)

Concepts and data developed as part of the Preliminary Space Station Automation and Robotics Plan are reviewed as well as candidate selection criteria, technology assessments, and preliminary candidate recommendations. A need for development of advanced operator/systems interface (OSI) concepts to support future Space Station automation and robotics applications is identified. Four candidate applications, illustrating the potential benefits of an advanced OSI, are described. These include: (1) a conversational OSI system, (2) a laboratory experiment manipulator system, (3) a module safety advisor, and (4) an integrated

maintenance/training system. These specific automation and robotics applications are expected to occur relatively early in the growth of the Space Station and to provide significant commercial and station benefits throughout the life of the station. Author

N86-30338*# California Univ., Davis. Dept. of Psychology.
IMPLICATIONS OF PRIVACY NEEDS AND INTERPERSONAL DISTANCING MECHANISMS FOR SPACE STATION DESIGN Progress Report, Jul. - Aug. 1985
A. A. HARRISON, R. SOMMER, N. STRUTHERS, and K. HOYT
30 Aug. 1985 26 p
(Contract NAG2-357)
(NASA-CR-176938; NAS 1.26:176938) Avail: NTIS HC A03/MF A01 CSCL 05H

Privacy needs, or the need of people to regulate their degree of contact with one another, and interpersonal distancing mechanisms, which serve to satisfy these needs, are common in all cultures. Isolation, confinement, and other conditions associated with space flight may at once accentuate privacy needs and limit the availability of certain common interpersonal contact. Loneliness occurs when people have less contact with one another than they desire. Crowding occurs when people have more contact with one another than they desire. Crowding, which is considered the greater threat to members of isolated and confined groups, can contribute to stress, a low quality of life, and poor performance. Drawing on the general literature on privacy, personal space, and interpersonal distancing, and on specialized literature on life aboard spacecraft and in spacecraft-analogous environments, a quantitative model for understanding privacy, interpersonal distancing, loneliness, and crowding was developed and the practical implications of this model for space station design were traced. Author

N86-30339*# SRI International Corp., Menlo Park, Calif.
SPECIFICATIONS PHYSIOLOGICAL MONITORING SYSTEM
15 Jul. 1985 73 p
(Contract NAS9-16811)
(NASA-CR-171926; NAS 1.26:171926) Avail: NTIS HC A04/MF A01 CSCL 06B

The operation of a physiological monitoring system (PMS) is described. Specifications were established for performance, design, interface, and test requirements. The PMS is a compact, microprocessor-based system, which can be worn in a pack on the body or may be mounted on a Spacelab rack or other appropriate structure. It consists of two modules, the Data Control Unit (DCU) and the Remote Control/Display Unit (RCDU). Its purpose is to collect and distribute data from physiological experiments in the Spacelab and in the Orbiter. Author

N86-30340# Clarke Ambrose, Inc., Knoxville, Tenn.
HUMAN FACTORS ACTIVITIES IN TELEOPERATOR DEVELOPMENT AT THE OAK RIDGE NATIONAL LABORATORY
J. V. DRAPER and J. N. HERNDON 1986 15 p Presented at the International Topical Meeting on Advances in Human Factors in Nuclear Power Systems, Knoxville, Tenn., 21 Apr. 1986 Prepared in cooperation with ORNL, Tenn.
(Contract DE-AC05-84OR-21400)
(DE86-005160; CONF-860415-2) Avail: NTIS HC A02/MF A01

The Consolidated Fuel Reprocessing Program (CFRP) at the Oak Ridge National Laboratory is developing advanced teleoperator systems for maintenance of future nuclear reprocessing facilities. Remote maintenance systems developed by the CFRP emphasize man-in-the-loop teleoperation. Consequently, human factors issues which affect teleoperator performance must be addressed. This paper surveys research and development activities carried out by the human factors group within the Remote Control Engineering Task of the CFRP. DOE

N86-30341# Foersvarets Forskingsansalt, Stockholm (Sweden).
ASSISTED POSITIVE PRESSURE BREATHING AND MODIFIED ANTI-ACCELERATION SUIT FILLING TESTED UP TO 9 G IN A HUMAN CENTRIFUGE, KAROLINSKA INSTITUTE
U. I. BALDIN Feb. 1986 14 p In SWEDISH; ENGLISH summary Sponsored by Swedish Material Administration of Armed Forces Air Material Department
(FOA-C-50038-H1; ISSN-0347-7665; ESA-86-97242) Avail: NTIS HC A02/MF A01

A modified anti-acceleration suit with ready pressure, faster filling, and higher end-pressure combined with normal breathing, and assisted and unassisted positive pressure breathing, was tested. Two acceleration-induced losses of consciousness occur at 8 to 9 G with normal breathing, but not with positive pressure breathing. Further negative physiological reactions are not recorded. Assisted positive pressure breathing is usually rated as best. Additional physical inconvenience occurs as a consequence of the high acceleration stresses, irrespective of equipment. ESA

N86-31218*# Georgia Inst. of Tech., Atlanta. Center for Man-Machine Systems Research.
PILOT INTERACTION WITH AUTOMATED AIRBORNE DECISION MAKING SYSTEMS Semiannual Progress Reports, Aug. - Jul. 1985
W. B. ROUSE, J. M. HAMMER, C. M. MITCHELL, N. M. MORRIS, C. M. LEWIS, and W. C. YOON Jul. 1985 50 p
(Contract NAG2-123)
(NASA-CR-176986; NAS 1.26:176986) Avail: NTIS HC A03/MF A01 CSCL 05H

Progress was made in the three following areas. In the rule-based modeling area, two papers related to identification and significance testing of rule-based models were presented. In the area of operator aiding, research focused on aiding operators in novel failure situations; a discrete control modeling approach to aiding PLANT operators was developed; and a set of guidelines were developed for implementing automation. In the area of flight simulator hardware and software, the hardware will be completed within two months and initial simulation software will then be integrated and tested.

N86-31219*# Georgia Inst. of Tech., Atlanta.
REPRESENTATION FOR CLOSED FORM SIGNIFICANCE TESTING IN VL1
C. M. LEWIS *In its* Pilot Interaction With Automated Airborne Decision Making Systems 11 p Jul. 1985
Avail: NTIS HC A03/MF A01 CSCL 05H

Within the constraints of the syntax language, the set of observation descriptions which determines the discriminations which can be made, and the number of observations classified, a method is to be devised for determining the relative frequency over instantiation with which a rule of equal or greater generality would be identified. Generality, here, is defined as the number of observations described by a rule. A covering algorithm (Aq, Michalski 1973) was used to identify pilot strategy (system of rules) in maneuvering to avoid intruders. B.G.

N86-31220*# Georgia Inst. of Tech., Atlanta.
A DISCRETE CONTROL MODEL OF PLANT
C. M. MITCHELL *In its* Pilot Interaction With Automated Airborne Decision Making Systems 31 p Jul. 1985
Avail: NTIS HC A03/MF A01 CSCL 05H

A model of the PLANT system using the discrete control modeling techniques developed by Miller is described. Discrete control models attempt to represent in a mathematical form how a human operator might decompose a complex system into simpler parts and how the control actions and system configuration are coordinated so that acceptable overall system performance is achieved. Basic questions include knowledge representation, information flow, and decision making in complex systems. The structure of the model is a general hierarchical/heterarchical scheme which structurally accounts for coordination and dynamic focus of attention. Mathematically, the discrete control model is

defined in terms of a network of finite state systems. Specifically, the discrete control model accounts for how specific control actions are selected from information about the controlled system, the environment, and the context of the situation. The objective is to provide a plausible and empirically testable accounting and, if possible, explanation of control behavior. B.G.

N86-31221# Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF THERMOELECTRIC WATER HEATING-COOLING DEVICES Final Rept. Feb. - Oct. 1985
 B. MATHIPRAKSAM 25 Oct. 1985 28 p
 (Contract DAAK60-85-C-0011; DA PROJ. 1L1-62724-AH-99)
 (AD-A166949; NATICK-TR-86/019) Avail: NTIS HC A03/MF A01 CSCL 13A

A simple, safe, and reliable thermoelectric device for heating or cooling potable water for use in military vehicles was developed. The unit is capable of cooling water to 60 F in ambient temperatures up to 130 F and heating to 150 F in ambient temperatures of 40 F. Freezing/overheating and undervoltage protections are provided. The unit has also cooling/heating indicators, water ready indicators, and automatic switch off. A total of six units were built, tested, and delivered to U.S. Army Natick R&D Center. Author (GRA)

N86-31222# Sandia National Labs., Albuquerque, N. Mex.
MAKING THE HUMAN-MACHINE INTERFACE RESPONSIVE TO MANY CLASSES OF USERS
 R. W. BARNARD 1986 15 p Presented at the DECUS Symposium, Dallas, Tex., 27 Apr. 1986
 (Contract DE-AC04-76DP-00789)
 (DE86-003453; CONF-860470-1) Avail: NTIS HC A02/MF A01

An applications program must be able to interact with users who have a range of familiarity with its operation. A novice user needs more guidance than an experienced one, and a rigid type of interaction (such as menus) will not meet the needs of all users. Frustrations with the program are reduced and productivity is increased by using a flexible means of response which matches the level of response to the needs of the user. This paper illustrates techniques to provide only as much guidance as the user requires. The methods discussed here permit the user to switch among three levels of guidance (none, short prompts, and menus) and to have context-sensitive help readily available. Because frequent users of a program will soon become quite proficient, supplying default answers and command entry shortcuts are also beneficial. These techniques have been used in a program which meets the needs of users who have all ranges of proficiency. DOE

N86-31223# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. System Safety Development Center.
BASIC HUMAN FACTORS CONSIDERATIONS
 R. J. NERTNEY and D. L. FILLMORE Dec. 1985 37 p
 (Contract DE-AC07-76ID-01570)
 (DE86-008181; SSDC-34) Avail: NTIS HC A03/MF A01

Models and concepts for analyzing the human element in working programs and systems are introduced. The method of attack is a functional one based on analysis of the work to be done (job-task analysis). Based on the results of the job-task analysis, psychological and physiological requirements and criteria can be defined for the system. DOE

N86-31224# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. System Safety Development Center.
IMPACT OF THE HUMAN ON SYSTEM SAFETY ANALYSIS
 R. J. NERTNEY and R. L. HORMAN Sep. 1985 34 p
 (Contract DE-AC07-76ID-01570)
 (DE86-008182; SSDC-32) Avail: NTIS HC A03/MF A01

The impact of the human and human reliability on the results of probabilistic risk assessment studies is discussed in terms of some of the standard models used in risk quantification. Three levels of analysis are considered: (1) identification of areas where the human affects the operational risks; (2) rough scaling and quantification of the effect of the human on operational outcome; and (3) complete quantification of the risks including consideration of human reliability. DOE

N86-31225# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.

PROCESS OF TASK ANALYSIS

H. S. BLACKMAN, D. I. GERTMAN, and L. N. HANEY Sep. 1985 32 p
 (Contract DE-AC07-76ID-01570)
 (DE86-008183; EGG-SSDC-31) Avail: NTIS HC A03/MF A01

The paper presents a task analysis form for the organization of task analysis efforts. In terms of the form, task descriptions for use in task analysis data collection are given, and detailed definitions of 35 task analysis categories are offered. The categories include important aspects of task performance, consequences, and feedback, as well as aspects of training and knowledge requirements. Methods behind the derivations of tasks and subtasks, and category analysis are explained. Aspects of data applications concerning who and how are discussed. Task analysis can be used in the development of behavioral learning objectives and instructional strategies. Action verbs are often used in category analysis and human capabilities identification. Curriculum and tests may be developed by analyzing what people do and need in their jobs. The process of task analysis is a useful tool in the analysis and improvement of human job performance. DOE

N86-31226# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. System Safety Development Center.

HUMAN FACTORS MANAGEMENT

R. J. NERTNEY and D. L. FILLMORE Jul. 1985 44 p
 (Contract DE-AC07-76ID-01570)
 (DE86-008184; SSDC-30) Avail: NTIS HC A03/MF A01

Evaluating a system to determine if it has the right people working using the right procedures and management controls with the right hardware at all times is the facet of human factors discussed in this manual. The following areas of concern are specifically addressed: (1) the selection process must be proper to select qualified workers who are given proper training for the work and whose skills are maintained; (2) a proper behavioral climate must be established at the work station; (3) all task assignments must contain elements of instruction and training; and (4) all supporting systems must interact with the human to ensure that the work can be completed. All of these areas of concern can be successfully completed using the existing company organization by following the considerations presented in this document and maintaining proper interfaces between the different branches of the company. DOE

N86-31412*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

EVALUATING SPACE STATION APPLICATIONS OF AUTOMATION AND ROBOTICS TECHNOLOGIES FROM A HUMAN PRODUCTIVITY POINT OF VIEW

J. F. BARD In its NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1985 46 p Jul. 1986
 Avail: NTIS HC A99/MF E03 CSCL 05H

The role that automation, robotics, and artificial intelligence will play in Space Station operations is now beginning to take shape. Although there is only limited data on the precise nature of the payoffs that these technologies are likely to afford there is a general consensus that, at a minimum, the following benefits will be realized: increased responsiveness to innovation, lower operating costs, and reduction of exposure to hazards. Nevertheless, the question arises as to how much automation can be justified with the technical and economic constraints of the program? The purpose of this paper is to present a methodology which can be used to evaluate and rank different approaches to automating the functions and tasks planned for the Space Station. Special attention is given to the impact of advanced automation on human productivity. The methodology employed is based on the Analytic Hierarchy Process. This permits the introduction of individual judgements to resolve the conflict that normally arises when incomparable criteria underly the selection process. Because of the large number of factors involved in the model, the overall

problem is decomposed into four subproblems individually focusing on human productivity, economics, design, and operations, respectively. The results from each are then combined to yield the final rankings. To demonstrate the methodology, an example is developed based on the selection of an on-orbit assembly system. Five alternatives for performing this task are identified, ranging from an astronaut working in space, to a dexterous manipulator with sensory feedback. Computational results are presented along with their implications. A final parametric analysis shows that the outcome is locally insensitive to all but complete reversals in preference. Author

N86-31422*# Utah Univ., Salt Lake City. Center for Occupational and Environmental Health.

DEFINING RECLAIMED WATER POTABILITY REQUIREMENTS

D. S. JANIK / In NASA. Johnson Space Center NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1985 49 p Jul. 1986

Avail: NTIS HC A99/MF E03 CSCL 06K

Water used during previous space missions has been either carried or made aloft. Future human space endeavors will probably have to utilize some form of water reclamation and recycling. There is little applied experience in either the US or foreign space programs with this technology. Water reclamation and recycling constitutes an engineering challenge of the broadest nature and will require an intensive research and development effort if this technology is to mature in time for practical use on the proposed US spacestation. In order for this to happen, reclaimed/recycled water specification will need to be devised to guide engineering development. Perhaps the most stringent specifications will involve water to be consumed. NASA's present Potable Water Specifications are not applicable to reclaimed or recycled potable water. No specifications for reclaimed or recycled potable water presently exist either inside or outside NASA. NASA's past experience with potable water systems is reviewed, limitations of the present Potable Water Specifications are examined, present world expertise with potable water reclamation/recycling systems and system analogs is reviewed, and an approach to developing pertinent Reclaimed/Recycled Potable Water Specifications for spacecraft is presented. Author

55

PLANETARY BIOLOGY

Includes exobiology; and extraterrestrial life.

A86-43927#

THE QUESTION OF LIFE ON MARS

B. ADELMAN British Interplanetary Society, Journal (Solar System Exploration) (ISSN 0007-084X), vol. 39, June 1986, p. 256-262. refs

The discoveries made with respect to Martian life are described with particular emphasis placed on the Viking Lander biology experiments. Post-Viking research is discussed along with plans for further investigation on future missions. The views of Levin and Straat (1981) are outlined with attention given to the following: (1) oxidizing compounds, (2) the adverse effects of water, (3) the heating of controls, (4) the absence of organic compounds, and (5) the notion that the results of the Gas Exchange Experiment and the Labeled Release Experiment are nonbiological. The presumed properties of Martian life (if it does exist) include the following: (1) Martian life is carbon based, (2) Martian organisms are microscopic in size, (3) they are anaerobes functioning at a low metabolic level, and (4) they are highly resistant to extreme cold and dryness. Criteria established by the National Research Council for Martian life are outlined. K.K.

A86-44354* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

DIATOMS ON EARTH, COMETS, EUROPA AND IN INTERSTELLAR SPACE

R. B. HOOVER, M. J. HOOVER (NASA, Marshall Space Flight Center, Huntsville, AL), F. HOYLE, N. C. WICKRAMASINGHE, and S. AL-MUFTI (University College, Cardiff, Wales) Earth, Moon, and Planets (ISSN 0167-9295), vol. 35, May 1986, p. 19-45. refs

There exists a close correspondence between the measured infrared properties of diatoms and the infrared spectrum of interstellar dust as observed in the Trapezium nebula and toward the galactic center source GC-IRS 7. Diatoms and bacteria also exhibit an absorbance peak near 2200 A, which is found to agree with the observed ultraviolet absorbance properties of interstellar grains. The observational data are reviewed, and the known properties of diatoms and bacteria are considered. It is suggested that these characteristics are consistent with the concept of a cosmic microbiological system in which these or similar microorganisms might exist on comets, Europa and in interstellar space. Author

A86-44358

THE VIABILITY WITH RESPECT TO TEMPERATURE, OF MICRO-ORGANISMS INCIDENT ON THE EARTH'S ATMOSPHERE

F. HOYLE, N. C. WICKRAMASINGHE, and S. AL-MUFTI (University College, Cardiff, Wales) Earth, Moon, and Planets (ISSN 0167-9295), vol. 35, May 1986, p. 79-84.

Laboratory tests on *E. coli* types ATCC/0537 and ATCC/35218 established the survival of bacteria on flash heating in a vacuum to at least 800 K. The experimental results, and the model developed for a microorganism impacting the terrestrial atmosphere, determined that essentially all microorganisms in prograde orbits could be added to the earth without losing viability due to heating as they were slowed by the atmospheric gases. R.R.

N86-30342*# Columbia Univ., New York.

EFFECTS OF SIMULATED WEIGHTLESSNESS ON MEIOSIS. FERTILIZATION, AND EARLY DEVELOPMENT IN MICE Final Report, 1 Jul. 1982 - 30 Apr. 1986

D. J. WOLGEMUTH 1986 18 p

(Contract NAG2-324)

(NASA-CR-177106; NAS 1.26:177106) Avail: NTIS HC A02/MF A01 CSCL 06C

The initial goal was to construct a clinostat which could support mammalian cell culture. The clinostat was selected as a means by which to simulate microgravity conditions within the laboratory, by constant re-orientation of cells with respect to the gravity vector. The effects of this simulated microgravity on in-vitro meiotic maturation of oocytes, using mouse as the model system, was investigated. The effects of clinostat rotation on fertilization in-vitro was then examined. Specific endpoints included examining the timely appearance of male and female pronuclei (indicating fertilization) and the efficiency of extrusion of the second polar body. Particular attention was paid to detecting anomalies of fertilization, including parthenogenetic activation and multiple pronuclei. Finally, for the preliminary studies on mouse embryogenesis, a key feature of the clinostat was modified, that of the position of the cells during rotation. A means was found to immobilize the cells during the clinostat rotation, permitting the cells to remain at the axis of rotation yet not interfering with cellular development. B.G.

N86-30343*# Maryland Univ., Baltimore. Dept. of Neurology.
**A POSSIBLE ROLE FOR ENDOGENOUS GLUCOCORTICOIDS
 IN ORCHIECTOMY-INDUCED ATROPHY OF THE RAT LEVATOR
 ANI MUSCLE: STUDIES WITH RU38486, A POTENT AND
 SELECTIVE ANTIGLUCOCORTICOID**

M. KONAGAYA (Nara Medical Coll., Japan) and S. R. MAX Nov. 1985 17 p Submitted for publication
 (Contract NAG2-100)
 (NASA-CR-177029; NAS 1.26:177029) Avail: NTIS HC A02/MF A01 CSCL 06C

RU38486, a potent and selective antiglucocorticoid, was employed to study a possible role for endogenous glucocorticoids in atrophy of the levator ani muscle secondary to castration of male rats. RU38486 was shown to block (3H) triamcinolone acetate binding to cytosol from levator ani muscle. Daily oral administration of RU38486 to castrated rats partially prevented atrophy of the levator ani muscle, as well as a decrease in RNA concentration. In a control group receiving RU38486 alone, the levator ani underwent significant (20%) hypertrophy. Administration of exogenous dexamethasone also caused pronounced atrophy of the levator ani muscle. This atrophy was prevented, to a significant degree, by simultaneous oral administration of RU38486. It is concluded that endogenous glucocorticoids, the actions of which are blocked by RU38486, may be involved in regulation of the mass of the levator ani muscle in intact rats. M.G.

N86-30344# Pacific Northwest Labs., Richland, Wash.
**BIOLOGICAL STUDIES OF SWINE EXPOSED TO 60-HZ
 ELECTRIC FIELDS. VOLUME 5: HEMATOLOGY AND SERUM
 CHEMISTRY Final Report**

Dec. 1985 127 p
 (Contract DE-AC06-76RL-01830)
 (DE86-005362; EPRI-EA-4318-VOL-5) Avail: NTIS HC A07/MF A01

The hematologic and serum chemistry responses in three generations of miniature swine chronically exposed to a 30-kV/m, 60-Hz electric field have been assessed in a series of screening experiments. Based on comprehensive analyses and sequential statistical evaluation of the data, there are no significant differences in any hematologic parameters in either the F sub 0 or F sub 1 generations when the exposed and sham exposed groups are compared. In F sub 2 swine, at 42 days of age reticulocyte values were significantly higher in both sexes exposed to the electric field than in the control group. In addition, the exposed males at 42 days had significantly lower values for erythrocytes, hemoglobin and volume of packed red cells than the control males. Other values were comparable between exposed and control groups. Serum chemistry evaluations between exposed and control groups also showed no consistent statistical differences. A few parameters did show occasional differences between groups in the F sub 1 and F sub 2 generations, including: higher levels of urea nitrogen, triglyceride and alkaline phosphatase in exposed F sub 1 piglets; significantly lower serum protein levels in exposed F sub 2 males; and fewer serum globulins in both sexes of the F sub 2 generation. In summary, when hematologic and serum chemistry parameters were compared in exposed and sham-exposed groups of swine, some sporadic effects were evident. These effects, however, failed to replicate consistently at subsequent sampling periods or across generations and were not present as statistical trends when appropriate multivariate analyses were performed. DOE

N86-30345# Pacific Northwest Labs., Richland, Wash.
**BIOLOGICAL STUDIES OF SWINE EXPOSED TO 60-HZ
 ELECTRIC FIELDS. VOLUME 6: IMMUNOLOGY Final Report**

Dec. 1985 61 p
 (Contract DE-AC06-76RL-01830)
 (DE86-005363; EPRI-EA-4318-VOL-6) Avail: NTIS HC A04/MF A01

Immunological response in three generations of miniature swine chronically exposed to a 30-kV/m, 60-Hz electric field have been assessed in a series of screening experiments. The study was designed to investigate functional aspects of the humoral and cellular components of the mammalian immune system. Circulating

levels of immunoglobulins were measured in parental-generation (F sub 0) sows (0 to 22 months of exposure), first-generation fetuses (F sub 1) at 100 days of gestation, F sub 1 females (0 to 32 months of exposure) and second-generation (F sub 2) weanlings at 1.5 and 6 months of age. No consistent, statistically significant changes in the levels of serum immunoglobins were observed when exposed groups were compared with sham-exposed controls, either within or across generations. An examination of cellular immunity included measurements of the mitogen response of peripheral-blood lymphocytes (PBL), spleen cells and lymph-node cells of F sub 0 sows sacrificed after 100 days of pregnancy, and PBL, spleen cells and thymocytes of F sub 1 fetuses at 100 days of gestation. Mitogen response studies of PBL, spleen cells, thymocytes and lymph-node cells of 42-day-old F sub 1 male weanlings and F sub 2 male and female swine were also conducted. In the statistical comparisons of mitogen-response data obtained for F sub 0, F sub 1, and F sub 2 swine, no consistent differences were observed between exposed and matched sham-exposed control groups. These observations indicate that the distribution of cells in the various tissues studied and the responses observed were not altered as a result of exposure to the fields. DOE

N86-30346# Southwest Research Inst., San Antonio, Tex.
**EFFECTS OF 60 HZ ELECTRIC FIELD ON OPERANT AND
 SOCIAL STRESS BEHAVIORS OF NONHUMAN PRIMATES
 Technical Status Report, Jun. 8 - 2 Aug. 1985**

2 Aug. 1985 19 p
 (Contract DE-AC02-80RA-50219)
 (DE85-016121; DOE/RA-50219/T5) Avail: NTIS HC A02/MF A01

Progress made at calibrating the electric field distribution within and around cages used for behavioral testing of baboons is described. It is concluded that all of the parts of the system are rather constant in their readings. The only component which seems to show appreciable variability is the 4 cm probe. Although the optically coupled 4 cm spherical dipole probe usually performs well, it is becoming apparent that sometimes it can produce misleading results. Although we do not yet understand the situation completely, it appears as though there are at least two variables affecting the probe, battery voltage and humidity. DOE

N86-30347# Southwest Research Inst., San Antonio, Tex.
**EFFECTS OF 60 HZ ELECTRIC FIELDS ON OPERANT AND
 SOCIAL STRESS BEHAVIORS OF NONHUMAN PRIMATES
 Project Technical Status Report, 23 Nov. 1985 - 17 Jan. 1986**

24 Jan. 1986 13 p
 (Contract DE-AC02-80RA-50219)
 (DE86-005807; DOE/RA-50219/T8) Avail: NTIS HC A02/MF A01

The objective was to investigate, using baboons (*Supercynopithecus*) as surrogates, possible behavioral effects associated with exposure to high intensity 60 Hz electric fields. This program consists of four major projects. The first will evaluate the potential aversive character of exposure to 60 Hz electric fields by determining the threshold intensity which produces avoidance or escape responses. The second project will estimate the threshold intensity for detection of 60 Hz electric fields. The third will assess effects of chronic exposure to 60 Hz electric fields on the performance of two operant conditioning tasks, fixed ratio (FR) and differential reinforcement of low rate responding (DRL). The fourth will investigate the possible stress-inducing effects of chronic exposure to 60 Hz electric fields on the behavior of baboons living in small social groups. DOE

N86-30348# Institute of Nuclear Energy Research, Lung-Tan (Taiwan).

BACTERIAL INACTIVATION BY MEANS OF IONIZING RADIATION

M. S. CHANG, L. H. CHEN, and Y. K. FU Nov. 1984 19 p In CHINESE and ENGLISH (DE86-901038; INER-0575) Avail: NTIS (US Sales Only) HC A02/MF A01

Spores of *Bacillus subtilis* and *Escherichia coli* are the most common air-borne bacteria. *B. subtilis* is radiation resistant and is commonly used as the test strain for routine control of heat sterilization. A study of surviving fractions of spores of *B. subtilis*, *E. coli*, and *Streptococcus faecium* A21 irradiated by (60)Co gamma-rays was carried out to determine the suitable dose for medical sterilization by irradiation. DOE

N86-31421*# East Carolina Univ., Greenville, N.C. Dept. of Biology.

EFFECTS OF LUNAR SOIL, ZAGAMI METEORITE, AND OCEAN RIDGE BASALT ON THE EXCRETION OF ITOIC ACID, A SIDEROPHORE, AND COPROPORPHYRIN BY BACILLUS SUBTILIS

T. ITO /In NASA. Johnson Space Center NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1985 12 p Jul. 1986

Avail: NTIS HC A99/MF E03 CSCL 06C

Samples of lunar soil (10084,151), Zagami meteorite, postulated to be ejected from Mars, and ocean ridge basalt, the most abundant volcanic rock on earth, all completely inhibited the excretion of itoic acid and of coproporphyrin by *Bacillus subtilis*, a common airborne bacterium. Since such inhibition has been known to occur only under iron rich growth conditions (the excretion of these compounds occurs under iron deficient growth conditions), the result indicated that the organism was capable of extracting iron quite readily from these materials. A sample of synthetic ilmenite completely failed to inhibit the excretion of coproporphyrin, and inhibited the excretion of itoic acid only slightly. The result suggested that much of the iron extracted by the organism must have come from iron sources other than ilmenite, such as pyroxenes and olivines, in these natural materials tested. Author

N86-31431*# Texas Univ., Houston. Dept. of Environmental Sciences.

CYTOGENETIC ANALYSES OF PERIPHERAL LYMPHOCYTES SUBJECTED TO SIMULATED SOLAR FLARE RADIATION

H. M. PRICHARD /In NASA. Johnson Space Center NASA/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1985 9 p Jul. 1986

Avail: NTIS HC A99/MF E03 CSCL 06R

Solar flare protons share many radiological health characteristics of the inner Van Allen Belt protons, and both types of radiation pose serious dangers to a number of missions planned. It is appropriate to evaluate crew dose determination procedures in terms of the type of radiation responsible for the major part of the projected exposure, i.e., protons in the neighborhood of 100 MeV. Monitoring chromosome abnormalities in peripheral lymphocytes is one method to determine an individual's accumulated radiation dosage. Cell culture and harvest is a relatively simple procedure and is well within the capabilities of a station health facility, but the evaluation of prepared microscopic slides is a time consuming and subjective procedure. This project is part of an effort to demonstrate the utility of automated image processing and evaluation procedures in expediting dose evaluation. The initial goal of this project is to produce a set of reference chromosome spreads produced from control lymphocytes and from lymphocytes exposed in whole blood to protons or gamma rays. The results of manual and automated aberration scoring will ultimately be compared to test for systematic differences between the two evaluation procedures and between the two radiation qualities. Proton irradiations are performed at the University of Texas Health Science Center at Houston Cyclotron Facility. Proton dosimetry is supplemented by TLD packets from and by assay of

short-lived proton activation products in the irradiation blood samples. Author

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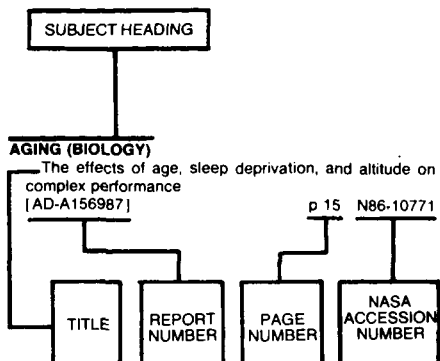
SELECTION OF AN APPROPRIATE ANIMAL MODEL FOR STUDY OF BONE LOSS IN WEIGHTLESSNESS

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Avail: NTIS HC A99/MF E03 CSCL 06S

Prolonged weightlessness in space flight results in a slow progressive demineralization of bone accompanied by an increased calcium output in the urine resulting in negative calcium balances. This possibly irreversible bone loss may constitute a serious limiting factor to long duration manned space flight. A number of preventative measures have been suggested, i.e., exercise during flight, dietary calcium supplements, use of specific prophylactic drugs. In order to facilitate research in these areas it is necessary to develop appropriate ground-based animal models that simulate the human condition of osteoporosis. An appropriate animal model would permit bone density studies, calcium balance studies, biochemical analyses, ground-based simulation models of weightlessness (bed rest, restraint, immobilization) and the planning of inflight experiments. Several animal models have been proposed in the biomedical research literature, but have inherent deficiencies. The purpose of this project was to evaluate models in the literature and determine which of these most closely simulates the phenomenon of bone loss in humans with regard to growth, bone remodeling, structural, chemical and mineralization similarities to human. This was accomplished by a comprehensive computer assisted literature search and report. Three animal models were examined closely for their relative suitability: the albino rat, monkey, and Beagle. Author

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

ACCELERATION STRESSES (PHYSIOLOGY)

- Human factors problems in the tactical air command p 396 A86-44778
- Inflight loss of consciousness - A first look at the U.S. Navy experience p 396 A86-44780
- Continuous ECG monitoring of Mirage 2000 pilots (comparison with Mirage 3 and F1 pilots) p 399 N86-30315
- The use of ECG changes caused by acceleration as tolerance prediction factors p 399 N86-30316
- The vertebral column: Selection and aptitude of combat aircraft pilots of the future p 400 N86-30322
- Assisted positive pressure breathing and modified anti-acceleration suit filling tested up to 9 G in a human centrifuge, Karolinska Institute [FOA-C-50038-H1] p 408 N86-30341

ACCELERATION TOLERANCE

- Physical training and +Gz tolerance reevaluated p 396 A86-44096
- Simulated aerial combat maneuvering tolerance and physical conditioning - Current status p 396 A86-44097
- G-induced loss of consciousness - Combat aircraft pilots head for trouble p 396 A86-44814
- The use of ECG changes caused by acceleration as tolerance prediction factors p 399 N86-30316
- Physical training of Mirage 2000 pilots p 401 N86-30324
- The effect of breathing elevated CO₂ gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz [AD-A165974] p 401 N86-31210

ACCURACY

- Spatiotemporal characteristics of visual localization [AD-A166097] p 404 N86-30331

ADAPTATION

- An environmentally-controlled extended-use small animal hypobaric chamber [AD-A166729] p 398 N86-30307
- Neurophysiological research supporting the investigation of adaptive network architectures [AD-A166074] p 405 N86-31216

ADAPTIVE CONTROL

- Experimental estimate of the parameters of a stochastic model of a human operator sensor system p 407 A86-45117

AEROSPACE ENVIRONMENTS

- Implications of privacy needs and interpersonal distancing mechanisms for space station design [NASA-CR-176938] p 408 N86-30338

AEROSPACE MEDICINE

- Low back pain in pilots p 395 A86-44092
- Air ambulance regulations - A model p 405 A86-44094
- Physical training and +Gz tolerance reevaluated p 396 A86-44096
- Effect of head-out water immersion on response to exercise training p 396 A86-44194
- An updated model for a Space Station Health Maintenance Facility [AIAA PAPER 86-2303] p 397 A86-46938
- Medical selection and physiological training of fighter pilots: A 1985 perspective and overview p 399 N86-30312
- Systematic radiographic examination of the spine for selection of F-16 pilots: A preliminary report p 401 N86-30323
- Hypobaric training of flight personnel without compromising quality of life p 401 N86-30327
- Cytogenetic analyses of peripheral lymphocytes subjected to simulated solar flare radiation p 412 N86-31431

AGE FACTOR

- Attention tasks and their relation to aging and flight experience [IZF-1986-4] p 405 N86-30337

AIR COOLING

- An environmentally-controlled extended-use small animal hypobaric chamber [AD-A166729] p 398 N86-30307

AIR FLOW

- Advantages of the gas exchange approach to microbiological studies [AD-A166887] p 393 N86-31207

AIR LAW

- Air ambulance regulations - A model p 405 A86-44094

AIRCRAFT MANEUVERS

- Simulated aerial combat maneuvering tolerance and physical conditioning - Current status p 396 A86-44097
- Visual capabilities related to fighter aircrew performance in the F-14 and adversary aircraft p 400 N86-30320
- Vision test battery threshold and response time as predictors of air-to-air visual target acquisition in F-14 and adversary aircraft p 400 N86-30321
- Representation for closed form significance testing in VL1 p 408 N86-31219

AIRCRAFT PILOTS

- Human factors problems in the tactical air command p 396 A86-44778
- Inflight loss of consciousness - A first look at the U.S. Navy experience p 396 A86-44780
- Medical Selection and Physiological Training of Future Fighter Aircrew [AGARD-CP-396] p 398 N86-30309
- Medical selection and physiological training of fighter pilots: A 1985 perspective and overview p 399 N86-30312
- Continuous ECG monitoring of Mirage 2000 pilots (comparison with Mirage 3 and F1 pilots) p 399 N86-30315
- The use of ECG changes caused by acceleration as tolerance prediction factors p 399 N86-30316
- The vertebral column: Selection and aptitude of combat aircraft pilots of the future p 400 N86-30322

Physical training of Mirage 2000 pilots

- p 401 N86-30324
 - Treadmill spiroergometry in the selection and screening of high-performance combat aircraft pilots in the Belgian Air Force p 401 N86-30325
- #### ALGAE
- Diatoms on earth, comets, Europa and in interstellar space p 410 A86-44354
 - Advantages of the gas exchange approach to microbiological studies [AD-A166887] p 393 N86-31207
- #### ALGORITHMS
- Representation for closed form significance testing in VL1 p 408 N86-31219
- #### ALTITUDE ACCLIMATIZATION
- The content of lactic acid in the blood and erythropoiesis during hypoxia p 393 A86-45324
- #### ALTITUDE SIMULATION
- An environmentally-controlled extended-use small animal hypobaric chamber [AD-A166729] p 398 N86-30307
- #### ALVEOLI
- Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia p 391 A86-44195
- #### AMBULANCES
- Air ambulance regulations - A model p 405 A86-44094
- #### ANALOGS
- Selection of an appropriate animal model for study of bone loss in weightlessness p 412 N86-31436
- #### ANGULAR ACCELERATION
- Single sinusoids compared with a multiple-sinusoids technique for evaluating horizontal semicircular canal function p 395 A86-44089
- #### ANIMALS
- An environmentally-controlled extended-use small animal hypobaric chamber [AD-A166729] p 398 N86-30307
 - Physical interaction of humans and animals with power-frequency electric and magnetic fields [DE86-007734] p 402 N86-31215
 - Selection of an appropriate animal model for study of bone loss in weightlessness p 412 N86-31436
- #### ANOMALIES
- Selection and medical testing of Mirage 2000 pilots: Report of echocardiography p 399 N86-30314
 - The use of ECG changes caused by acceleration as tolerance prediction factors p 399 N86-30316
 - Sensitivity to color contrasts and the selection of navigator personnel p 400 N86-30318
- #### ANTICHOLINERGICS
- Thermoregulation after atropine and pralidoxime administration [AD-A165868] p 397 N86-30304
- #### APPLICATIONS PROGRAMS (COMPUTERS)
- Representation for closed form significance testing in VL1 p 408 N86-31219
 - A discrete control model of PLANT p 408 N86-31220
 - Making the human-machine interface responsive to many classes of users [DE86-003453] p 409 N86-31222
- #### ARCHITECTURE
- Neurophysiological research supporting the investigation of adaptive network architectures [AD-A166074] p 405 N86-31216
- #### ARCHITECTURE (COMPUTERS)
- Novel architectures for image processing based on computer simulation and psychophysical studies of human visual cortex [AD-A166222] p 404 N86-30333
- #### ARTERIES
- Fluid dynamic study in a femoral artery branch casting of man with upstream main lumen curvature for steady flow p 397 A86-45254
 - Intrinsic alteration of the reactive properties of arteries during hypothermia [AD-A166523] p 402 N86-31213
- #### ARTIFICIAL INTELLIGENCE
- Evaluating space station applications of automation and robotics technologies from a human productivity point of view p 409 N86-31412

ASTRONAUT PERFORMANCE

Theoretical principles underlying the evaluation, control, and correction of the impact of emotions on cosmonaut activity p 403 A86-44601

ATMOSPHERIC HEATING

The viability with respect to temperature, of micro-organisms incident on the earth's atmosphere p 410 A86-44358

ATMOSPHERIC PRESSURE

An environmentally-controlled extended-use small animal hypobaric chamber [AD-A166729] p 398 N86-30307

ATROPHY

A possible role for endogenous glucocorticoids in orchiectomy-induced atrophy of the rat levator ani muscle: Studies with RU38486, a potent and selective antiglucocorticoid [DE86-005362] p 411 N86-30343
Flow cytometry analysis of hormone receptors on human peripheral blood mononuclear cells to identify stress-induced neuroendocrine effects p 403 N86-31428

ATTENTION

Enhanced detection in the aperture of focal attention during simple discrimination tasks p 403 A86-45955
Division of attention as a function of the number of steps, visual shifts, and memory load [NASA-TM-88775] p 404 N86-30328
Attention tasks and their relation to aging and flight experience [IZF-1986-4] p 405 N86-30337

ATTENUATION

Methods of measuring the attenuation of hearing protection devices p 406 A86-45073

AUDITORY STIMULI

Neurophysiological research supporting the investigation of adaptive network architectures [AD-A166074] p 405 N86-31216

AUTOMATIC CONTROL

Evaluating space station applications of automation and robotics technologies from a human productivity point of view p 409 N86-31412

AUTOMATION

Impact of automation on Space Station MMI design --- Man-Machine Interface [AIAA PAPER 86-2316] p 407 A86-46944
Advanced operator/system interface concepts for the Space Station [AIAA PAPER 86-2317] p 407 A86-46945

B

BABOONS

Effects of 60 Hz electric field on operant and social stress behaviors of nonhuman primates [DE85-016121] p 411 N86-30346
Effects of 60 Hz electric fields on operant and social stress behaviors of nonhuman primates [DE86-005807] p 411 N86-30347

BACILLUS

Bacterial inactivation by means of ionizing radiation [DE86-901038] p 412 N86-30348
Effects of lunar soil, Zagami meteorite, and ocean ridge basalt on the excretion of itoic acid, a siderophore, and coproporphyrin by *Bacillus subtilis* p 412 N86-31421

BACK INJURIES

Low back pain in pilots p 395 A86-44092

BASALT

Effects of lunar soil, Zagami meteorite, and ocean ridge basalt on the excretion of itoic acid, a siderophore, and coproporphyrin by *Bacillus subtilis* p 412 N86-31421

BEHAVIOR

Multiparameter data acquisition systems for studies of Circadian rhythms [DE86-004041] p 398 N86-30308
Effects of 60 Hz electric field on operant and social stress behaviors of nonhuman primates [DE85-016121] p 411 N86-30346
Effects of 60 Hz electric fields on operant and social stress behaviors of nonhuman primates [DE86-005807] p 411 N86-30347

BELGIUM

Treadmill spiroergometry in the selection and screening of high-performance combat aircraft pilots in the Belgian Air Force p 401 N86-30325

BIOASSAY

Advantages of the gas exchange approach to microbiological studies [AD-A166887] p 393 N86-31207

BIOASTRONAUTICS

The question of life on Mars
Space Station - Life sciences [AIAA PAPER 86-2346] p 393 A86-46960

BIOCHEMICAL OXYGEN DEMAND

Alteration of rat brain catecholamine levels under hypoxia p 391 A86-43540

BIOELECTRIC POTENTIAL

The inverse problem in electrocardiography - A model study of the effects of geometry and conductivity parameters on the reconstruction of epicardial potentials p 394 A86-43750

An investigation of the use of steady-state evoked potentials for human performance and workload assessment and control [AD-A166205] p 404 N86-30332

BIOGEOCHEMISTRY

Template-directed oligonucleotide ligation on hydroxylapatite p 393 A86-45960

BIOLOGICAL EFFECTS

Biological studies of swine exposed to 60-Hz electric fields. Volume 5: Hematology and serum chemistry [DE86-005362] p 411 N86-30344

Biological studies of swine exposed to 60-Hz electric fields. Volume 6: Immunology [DE86-005363] p 411 N86-30345

Physical interaction of humans and animals with power-frequency electric and magnetic fields [DE86-007734] p 402 N86-31215

BIOLOGICAL MODELS (MATHEMATICS)

The inverse problem in electrocardiography - A model study of the effects of geometry and conductivity parameters on the reconstruction of epicardial potentials p 394 A86-43750

Models of disuse - A comparison of hindlimb suspension and immobilization p 391 A86-44196

BIOPHYSICS

How well mixed is inert gas in tissues? p 391 A86-44197

BLACKOUT (PHYSIOLOGY)

Inflight loss of consciousness - A first look at the U.S. Navy experience p 396 A86-44780

BLACKOUT PREVENTION

G-induced loss of consciousness - Combat aircraft pilots head for trouble p 396 A86-44814

BLOOD

Induced erythrocythemia and maximal aerobic power: An examination of modifying factors [AD-A166522] p 402 N86-31212

BLOOD CIRCULATION

Thermoregulation after atropine and pralidoxime administration [AD-A165868] p 397 N86-30304

BLOOD FLOW

Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia p 391 A86-44195
Fluid dynamic study in a femoral artery branch casting of man with upstream main lumen curvature for steady flow p 397 A86-45254

BLOOD PLASMA

Continuous blood densitometry - Fluid shifts after graded hemorrhage in animals p 392 A86-45251

BLOOD PRESSURE

The possible involvement of PGI₂ in the PEEP-induced changes in cardiac output and blood pressure p 395 A86-44091

The effect of breathing elevated CO₂ gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz [AD-A165974] p 401 N86-31210

BLOOD VOLUME

Effect of head-out water immersion on response to exercise training p 396 A86-44194
Continuous blood densitometry - Fluid shifts after graded hemorrhage in animals p 392 A86-45251

BODY FLUIDS

Human vascular fluid responses to cold stress are not altered by cold acclimation [AD-A165869] p 398 N86-30305

BODY VOLUME (BIOLOGY)

The inverse problem in electrocardiography - A model study of the effects of geometry and conductivity parameters on the reconstruction of epicardial potentials p 394 A86-43750

BONE DEMINERALIZATION

The temporal response of bone to unloading [NASA-TM-89228] p 397 N86-30303
Selection of an appropriate animal model for study of bone loss in weightlessness p 412 N86-31436

BRAIN

Alteration of rat brain catecholamine levels under hypoxia p 391 A86-43540

BRAIN CIRCULATION

Correlations between the levels of cerebral blood flow and cerebrovascular reactivity and the functional state of brain tissue p 392 A86-45320

BRAIN DAMAGE

Correlations between the levels of cerebral blood flow and cerebrovascular reactivity and the functional state of brain tissue p 392 A86-45320

BREATHING APPARATUS

Assisted positive pressure breathing and modified anti-acceleration suit filling tested up to 9 G in a human centrifuge, Karolinska Institute [FOA-C-50038-H1] p 408 N86-30341

C

CALCIFEROL

Calcium and vitamin D metabolism in submariners: Carbon dioxide, sunlight and absorption considerations [AD-A166292] p 398 N86-30306

CALCIFICATION

Diffuse pulmonary ossification and spontaneous pneumothorax in a pilot - A case report p 395 A86-44093

CALCIUM METABOLISM

Calcium and vitamin D metabolism in submariners: Carbon dioxide, sunlight and absorption considerations [AD-A166292] p 398 N86-30306

CALCIUM PHOSPHATES

Template-directed oligonucleotide ligation on hydroxylapatite p 393 A86-45960

CALIBRATING

Effects of 60 Hz electric field on operant and social stress behaviors of nonhuman primates [DE85-016121] p 411 N86-30346

CANADA

Canadian forces approach to aircrew medical selection p 399 N86-30311

CAPILLARIES (ANATOMY)

Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia p 391 A86-44195

CAPILLARY FLOW

Changes in pericardial microcirculation in dogs during adaptation to static muscle loads p 392 A86-45321

CARBOHYDRATE METABOLISM

The contractile function and the energy metabolism of the myocardium under emotional stress and during adaptation of animals to short stress effects p 392 A86-45322

CARBON DIOXIDE

The suppressive effect of carbon dioxide on the activation of cold receptors in the nasal cavity of cats p 392 A86-45319

An environmentally-controlled extended-use small animal hypobaric chamber [AD-A166729] p 398 N86-30307

The effect of breathing elevated CO₂ gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz [AD-A165974] p 401 N86-31210

CARBON DIOXIDE CONCENTRATION

Correlations between the levels of cerebral blood flow and cerebrovascular reactivity and the functional state of brain tissue p 392 A86-45320

CARDIOLOGY

Circadian variations of systolic time intervals p 394 A86-44087
The possible involvement of PGI₂ in the PEEP-induced changes in cardiac output and blood pressure p 395 A86-44091

CARDIOVASCULAR SYSTEM

Medical Selection and Physiological Training of Future Fighter Aircrew [AGARD-CP-396] p 398 N86-30309

Cardiovascular standards for selection and retention of high performance pilots in the USAF: Perspectives for the next decade p 399 N86-30313

Treadmill spiroergometry in the selection and screening of high-performance combat aircraft pilots in the Belgian Air Force p 401 N86-30325

Relationship of cardiopulmonary fitness to flight performance in tactical aviation p 401 N86-30326

CATECHOLAMINE

Alteration of rat brain catecholamine levels under hypoxia p 391 A86-43540

CELL DIVISION

Effects of simulated weightlessness on meiosis. Fertilization, and early development in mice [NASA-CR-177106] p 410 N86-30342

CELLS (BIOLOGY)

Effects of simulated weightlessness on meiosis. Fertilization, and early development in mice [NASA-CR-177106] p 410 N86-30342

CEREBRAL CORTEX

The effects of cerebral hypoxia and hyperventilatory hypocapnia on the epileptiform activity in the cerebral cortex of cats p 392 A86-45318

Novel architectures for image processing based on computer simulation and psychophysical studies of human visual cortex [AD-A166222] p 404 N86-30333

Neurophysiological research supporting the investigation of adaptive network architectures [AD-A166074] p 405 N86-31216

CHEMICAL COMPOSITION
Advantages of the gas exchange approach to microbiological studies [AD-A166887] p 393 N86-31207

CHLORELLA
Advantages of the gas exchange approach to microbiological studies [AD-A166887] p 393 N86-31207

CINEMATOGRAPHY
Sensitivity to visual motion in statistically defined displays [AD-A167291] p 405 N86-31217

CIRCADIAN RHYTHMS
Digestive system rhythms and the body's biological clock p 391 A86-43676
Circadian variations of systolic time intervals p 394 A86-44087
Multiparameter data acquisition systems for studies of Circadian rhythms [DE86-004041] p 398 N86-30308

CLINICAL MEDICINE
Canadian forces approach to aircrew medical selection p 399 N86-30311
Cytogenetic analyses of peripheral lymphocytes subjected to simulated solar flare radiation p 412 N86-31431

CLOSED ECOLOGICAL SYSTEMS
Defining reclaimed water potability requirements p 410 N86-31422

COCKPITS
Aircrew aspects of United States future fighter aircraft p 398 N86-30310

COGNITION
The importance of specialized cognitive function in the selection of military pilots [AD-A165889] p 404 N86-30330

COGNITIVE PSYCHOLOGY
Cognitive aspects of command and control [IZF-1986-2] p 405 N86-30336

COLD ACCLIMATIZATION
The suppressive effect of carbon dioxide on the activation of cold receptors in the nasal cavity of cats p 392 A86-45319
Human vascular fluid responses to cold stress are not altered by cold acclimation [AD-A165869] p 398 N86-30305

COLOR
Sensitivity to color contrasts and the selection of navigator personnel p 400 N86-30318

COLOR CODING
The effects of color-coding in GEOSIT (geographical situational) displays. 2: Redundant versus non-redundant color-coding [AD-A166263] p 405 N86-30334

COMBAT
Simulated aerial combat maneuvering tolerance and physical conditioning - Current status p 396 A86-44097
The use of ECG changes caused by acceleration as tolerance prediction factors p 399 N86-30316
Visual capabilities related to fighter aircrew performance in the F-14 and adversary aircraft p 400 N86-30320
Vision test battery threshold and response time as predictors of air-to-air visual target acquisition in F-14 and adversary aircraft p 400 N86-30321

COMMAND AND CONTROL
Cognitive aspects of command and control [IZF-1986-2] p 405 N86-30336

COMPUTER GRAPHICS
The effects of color-coding in GEOSIT (geographical situational) displays. 2: Redundant versus non-redundant color-coding [AD-A166263] p 405 N86-30334

COMPUTER PROGRAMS
Pilot interaction with automated airborne decision making systems [NASA-CR-176986] p 408 N86-31218

COMPUTER TECHNIQUES
Computer analysis of visual and vestibular oculomotor function in the medical selection of fighter aircrew members p 400 N86-30319

COMPUTERIZED SIMULATION
Novel architectures for image processing based on computer simulation and psychophysical studies of human visual cortex [AD-A166222] p 404 N86-30333

COMPUTERS
Making the human-machine interface responsive to many classes of users [DE86-003453] p 409 N86-31222

CONDITIONING (LEARNING)
Effects of 60 Hz electric fields on operant and social stress behaviors of nonhuman primates [DE86-005807] p 411 N86-30347

CONTRACTION
The contractile function and the energy metabolism of the myocardium under emotional stress and during adaptation of animals to short stress effects p 392 A86-45322

CONTROL SYSTEMS DESIGN
Environmental control and life support systems p 406 A86-44534
A discrete control model of PLANT p 408 N86-31220

COOLING
Development of thermoelectric water heating-cooling devices [AD-A166949] p 409 N86-31221

CORONARY CIRCULATION
Changes in pericardial microcirculation in dogs during adaptation to static muscle loads p 392 A86-45321

CORTICOSTEROIDS
A possible role for endogenous glucocorticoids in orchietomy-induced atrophy of the rat levator ani muscle: Studies with RU38486, a potent and selective antiglucocorticoid [NASA-CR-177029] p 411 N86-30343

CREW WORKSTATIONS
Intelligent crew workstations p 406 A86-44532

CULTURE TECHNIQUES
Effects of simulated weightlessness on meiosis. Fertilization, and early development in mice [NASA-CR-177106] p 410 N86-30342
Advantages of the gas exchange approach to microbiological studies [AD-A166887] p 393 N86-31207

CURVATURE
Fluid dynamic study in a femoral artery branch casting of man with upstream main lumen curvature for steady flow p 397 A86-45254

CYTOLOGY
The photobiological aspects of radiation damage in cells --- Russian book p 392 A86-44295

D

DAMAGE ASSESSMENT
Assessing possible damage due to radio frequency radiation [AD-A166913] p 402 N86-31214

DATA ACQUISITION
Multiparameter data acquisition systems for studies of Circadian rhythms [DE86-004041] p 398 N86-30308

DECISION MAKING
Pilot interaction with automated airborne decision making systems [NASA-CR-176986] p 408 N86-31218
Representation for closed form significance testing in VL1 p 408 N86-31219
A discrete control model of PLANT p 408 N86-31220

DECLINATION
Preferred declination of the line of sight p 406 A86-45014

DECOMPRESSION SICKNESS
How well mixed is inert gas in tissues? p 391 A86-44197
Hypobaric training of flight personnel without compromising quality of life p 401 N86-30327

DENSITY MEASUREMENT
Continuous blood densitometry - Fluid shifts after graded hemorrhage in animals p 392 A86-45251

DESIGN ANALYSIS
An updated model for a Space Station Health Maintenance Facility [AIAA PAPER 86-2303] p 397 A86-46938

DETECTION
Detection of system failure by human operator. 1 - The case of monitor p 403 A86-43535

DIATOMIC MOLECULES
Diatoms on earth, comets, Europa and in interstellar space p 410 A86-44354

DIGESTIVE SYSTEM
Digestive system rhythms and the body's biological clock p 391 A86-43676
The role of gravity in producing digestive system changes p 391 A86-43677

DISPLAY DEVICES
Visual accommodation and virtual image displays - Target detection and recognition p 406 A86-45015
The effects of color-coding in GEOSIT (geographical situational) displays. 2: Redundant versus non-redundant color-coding [AD-A166263] p 405 N86-30334

E

EAR PROTECTORS
Methods of measuring the attenuation of hearing protection devices p 406 A86-45073

EARTH ATMOSPHERE
The viability with respect to temperature, of micro-organisms incident on the earth's atmosphere p 410 A86-44358

ECHOCARDIOGRAPHY
Selection and medical testing of Mirage 2000 pilots: Report of echocardiography p 399 N86-30314

EFFERENT NERVOUS SYSTEMS
Neurophysiological research supporting the investigation of adaptive network architectures [AD-A166074] p 405 N86-31216

ELECTRIC FIELDS
Biological studies of swine exposed to 60-Hz electric fields. Volume 5: Hematology and serum chemistry [DE86-005362] p 411 N86-30344
Biological studies of swine exposed to 60-Hz electric fields. Volume 6: Immunology [DE86-005363] p 411 N86-30345
Effects of 60 Hz electric field on operant and social stress behaviors of nonhuman primates [DE85-016121] p 411 N86-30346
Effects of 60 Hz electric fields on operant and social stress behaviors of nonhuman primates [DE86-005807] p 411 N86-30347
Physical interaction of humans and animals with power-frequency electric and magnetic fields [DE86-007734] p 402 N86-31215

ELECTRIC POTENTIAL
Effects of 60 Hz electric field on operant and social stress behaviors of nonhuman primates [DE85-016121] p 411 N86-30346

ELECTROCARDIOGRAPHY
The inverse problem in electrocardiography - A model study of the effects of geometry and conductivity parameters on the reconstruction of epicardial potentials p 394 A86-43750
Continuous ECG monitoring of Mirage 2000 pilots (comparison with Mirage 3 and F1 pilots) p 399 N86-30315

ELECTRONS
Laser kinetic spectroscopy of unimolecular and bimolecular processes in the gas phase [AD-A166998] p 394 N86-31209

EMERGENCY LIFE SUSTAINING SYSTEMS
Air ambulance regulations - A model p 405 A86-44094

EMOTIONAL FACTORS
Theoretical principles underlying the evaluation, control, and correction of the impact of emotions on cosmonaut activity p 403 A86-44601

ENVIRONMENTAL CONTROL
Environmental control and life support systems p 406 A86-44534
Environmental control/life support system for Space Station p 407 A86-45692
Growth evolution of the Space Station ECLSS [AIAA PAPER 86-2313] p 407 A86-46943

EPICARDIUM
The inverse problem in electrocardiography - A model study of the effects of geometry and conductivity parameters on the reconstruction of epicardial potentials p 394 A86-43750

EPILEPSY
The effects of cerebral hypoxia and hyperventilation hypoxia on the epileptiform activity in the cerebral cortex of cats p 392 A86-45318

EQUIPMENT SPECIFICATIONS
Effects of simulated weightlessness on meiosis. Fertilization, and early development in mice [NASA-CR-177106] p 410 N86-30342

ERROR ANALYSIS
Impact of the human on system safety analysis [DE86-008182] p 409 N86-31224

ERYTHROCYTES
The content of lactic acid in the blood and erythropoiesis during hypoxia p 393 A86-45324
Induced erythrocythemia and maximal aerobic power: An examination of modifying factors [AD-A166522] p 402 N86-31212

ESCHERICHIA
Bacterial inactivation by means of ionizing radiation [DE86-901038] p 412 N86-30348

EVOKED RESPONSE (PSYCHOPHYSIOLOGY)
An investigation of the use of steady-state evoked potentials for human performance and workload assessment and control [AD-A166205] p 404 N86-30332

EXCRETION
Effects of lunar soil, Zagami meteorite, and ocean ridge basalt on the excretion of itolic acid, a siderophore, and coproporphyrin by *Bacillus subtilis* p 412 N86-31421

EXERCISE PHYSIOLOGY

- Physical training and + Gz tolerance reevaluated
p 396 A86-44096
- Simulated aerial combat maneuvering tolerance and physical conditioning - Current status
p 396 A86-44097
- Effect of head-out water immersion on response to exercise training
p 396 A86-44194
- EXPERT SYSTEMS**
Evaluating space station applications of automation and robotics technologies from a human productivity point of view
p 409 N86-31412
- EXPOSURE**
Biological studies of swine exposed to 60-Hz electric fields. Volume 6: Immunology
[DE86-005363] p 411 N86-30345
- EXTRATERRESTRIAL LIFE**
The question of life on Mars
p 410 A86-43927
- EXTRAVEHICULAR ACTIVITY**
Advanced space suit development for future on-orbit operations
[AIAA PAPER 86-2310] p 407 A86-46941
Zero-G simulation verifies EVA servicing of space station modules
[AIAA PAPER 86-2312] p 407 A86-46942

F

- F-14 AIRCRAFT**
Visual capabilities related to fighter aircrew performance in the F-14 and adversary aircraft
p 400 N86-30320
- F-16 AIRCRAFT**
Systematic radiographic examination of the spine for selection of F-16 pilots: A preliminary report
p 401 N86-30323
Treadmill spiroergometry in the selection and screening of high-performance combat aircraft pilots in the Belgian Air Force
p 401 N86-30325
- FACILITIES**
An updated model for a Space Station Health Maintenance Facility
[AIAA PAPER 86-2303] p 397 A86-46938
- FATIGUE (BIOLOGY)**
An investigation of the use of steady-state evoked potentials for human performance and workload assessment and control
[AD-A166205] p 404 N86-30332
- FAULT TREES**
Impact of the human on system safety analysis
[DE86-008182] p 409 N86-31224
- FERTILIZATION**
Effects of simulated weightlessness on meiosis. Fertilization, and early development in mice
[NASA-CR-177106] p 410 N86-30342
- FETUSES**
Biological studies of swine exposed to 60-Hz electric fields. Volume 6: Immunology
[DE86-005363] p 411 N86-30345
- FIGHTER AIRCRAFT**
G-induced loss of consciousness - Combat aircraft pilots head for trouble
p 396 A86-44814
Medical Selection and Physiological Training of Future Fighter Aircrew
[AGARD-CP-396] p 398 N86-30309
Aircrew aspects of United States future fighter aircraft
p 398 N86-30310
Medical selection and physiological training of fighter pilots: A 1985 perspective and overview
p 399 N86-30312
Selection and medical testing of Mirage 2000 pilots: Report of echocardiography
p 399 N86-30314
Continuous ECG monitoring of Mirage 2000 pilots (comparison with Mirage 3 and F1 pilots)
p 399 N86-30315
Entry visual standards and ocular examination techniques for future fighter aircrew
p 400 N86-30317
Computer analysis of visual and vestibular oculomotor function in the medical selection of fighter aircrew members
p 400 N86-30319
Vision test battery threshold and response time as predictors of air-to-air visual target acquisition in F-14 and adversary aircraft
p 400 N86-30321
The vertebral column: Selection and aptitude of combat aircraft pilots of the future
p 400 N86-30322
Relationship of cardiopulmonary fitness to flight performance in tactical aviation
p 401 N86-30326
- FLIGHT CONTROL**
Aircrew aspects of United States future fighter aircraft
p 398 N86-30310
- FLIGHT CREWS**
The technology impact of the Advanced Technology Crew Protection (ATCP) system on high performance aircraft
p 406 A86-44779
Aircrew aspects of United States future fighter aircraft
p 398 N86-30310

- Canadian forces approach to aircrew medical selection
p 399 N86-30311
- Computer analysis of visual and vestibular oculomotor function in the medical selection of fighter aircrew members
p 400 N86-30319
- Visual capabilities related to fighter aircrew performance in the F-14 and adversary aircraft
p 400 N86-30320
- Hyobaric training of flight personnel without compromising quality of life
p 401 N86-30327
- Attention tasks and their relation to aging and flight experience
[IZF-1986-4] p 405 N86-30337
- FLIGHT FITNESS**
Canadian forces approach to aircrew medical selection
p 399 N86-30311
- FLIGHT SAFETY**
Inflight loss of consciousness - A first look at the U.S. Navy experience
p 396 A86-44780
- FLIGHT SIMULATION**
Simulated aerial combat maneuvering tolerance and physical conditioning - Current status
p 396 A86-44097
- FLIGHT TRAINING**
The significance of recurrent childhood respiratory disorders in flight training applicants
p 395 A86-44095
Cardiovascular standards for selection and retention of high performance pilots in the USAF: Perspectives for the next decade
p 399 N86-30313
- FLUID DYNAMICS**
Fluid dynamic study in a femoral artery branch casting of man with upstream main lumen curvature for steady flow
p 397 A86-45254
- FOCUSING**
Enhanced detection in the aperture of focal attention during simple discrimination tasks
p 403 A86-45955

G

- GALACTIC NUCLEI**
Diatoms on earth, comets, Europa and in interstellar space
p 410 A86-44354
- GAMMA RAYS**
Bacterial inactivation by means of ionizing radiation
[DE86-901038] p 412 N86-30348
- GAS EXCHANGE**
How well mixed is inert gas in tissues?
p 391 A86-44197
Advantages of the gas exchange approach to microbiological studies
[AD-A166887] p 393 N86-31207
- GEOGRAPHY**
The effects of color-coding in GEOSIT (geographical situational) displays. 2: Redundant versus non-redundant color-coding
[AD-A166263] p 405 N86-30334
- GRAPH THEORY**
The prediction of biological activity using molecular connectivity indices
[AD-A166986] p 394 N86-31208
- GRAVITATIONAL EFFECTS**
The temporal response of bone to unloading
[NASA-TM-89228] p 397 N86-30303
Medical Selection and Physiological Training of Future Fighter Aircrew
[AGARD-CP-396] p 398 N86-30309
Medical selection and physiological training of fighter pilots: A 1985 perspective and overview
p 399 N86-30312
Effects of simulated weightlessness on meiosis. Fertilization, and early development in mice
[NASA-CR-177106] p 410 N86-30342
- GRAVITATIONAL PHYSIOLOGY**
The role of gravity in producing digestive system changes
p 391 A86-43677
Single sinusoids compared with a multiple-sinusoids technique for evaluating horizontal semicircular canal function
p 395 A86-44089
Physical training and + Gz tolerance reevaluated
p 396 A86-44096
Simulated aerial combat maneuvering tolerance and physical conditioning - Current status
p 396 A86-44097
Effect of head-out water immersion on response to exercise training
p 396 A86-44194
Human factors problems in the tactical air command
p 396 A86-44778
G-induced loss of consciousness - Combat aircraft pilots head for trouble
p 396 A86-44814

H

HEALTH PHYSICS

- An updated model for a Space Station Health Maintenance Facility
[AIAA PAPER 86-2303] p 397 A86-46938

HEARING

- Methods of measuring the attenuation of hearing protection devices
p 406 A86-45073

HEART FUNCTION

- The possible involvement of PGI₂ in the PEEP-induced changes in cardiac output and blood pressure
p 395 A86-44091
The contractile function and the energy metabolism of the myocardium under emotional stress and during adaptation of animals to short stress effects
p 392 A86-45322
Selection and medical testing of Mirage 2000 pilots: Report of echocardiography
p 399 N86-30314
The use of ECG changes caused by acceleration as tolerance prediction factors
p 399 N86-30316

HEART RATE

- Circadian variations of systolic time intervals
p 394 A86-44087

HEAT TRANSFER

- The effect of high temperature on the heat exchange and the nutritional status of pilots
p 397 A86-45325

HEATING EQUIPMENT

- Development of thermoelectric water heating-cooling devices
[AD-A166949] p 409 N86-31221

HELMETS

- The vertebral column: Selection and aptitude of combat aircraft pilots of the future
p 400 N86-30322

HEMATOLOGY

- Biological studies of swine exposed to 60-Hz electric fields. Volume 5: Hematology and serum chemistry
[DE86-005362] p 411 N86-30344
Induced erythrocythemia and maximal aerobic power: An examination of modifying factors
[AD-A166522] p 402 N86-31212

HEMATOPOIESIS

- The content of lactic acid in the blood and erythropoiesis during hypoxia
p 393 A86-45324

HEMODYNAMIC RESPONSES

- Changes in pericardial microcirculation in dogs during adaptation to static muscle loads
p 392 A86-45321
The effect of hypoxia on the dynamics of the peripheral lymph flow
p 393 A86-45323

HEMODYNAMICS

- Fluid dynamic study in a femoral artery branch casting of man with upstream main lumen curvature for steady flow
p 397 A86-45254

HEMORRHAGES

- Continuous blood densitometry - Fluid shifts after graded hemorrhage in animals
p 392 A86-45251

HIGHLY MANEUVERABLE AIRCRAFT

- The technology impact of the Advanced Technology Crew Protection (ATCP) system on high performance aircraft
p 406 A86-44779

HORMONES

- A possible role for endogenous glucocorticoids in orchietomy-induced atrophy of the rat levator ani muscle: Studies with RU38486, a potent and selective antiglucocorticoid
[NASA-CR-177029] p 411 N86-30343

HUMAN BEINGS

- Spatiotemporal characteristics of visual localization
[AD-A166097] p 404 N86-30331
Physical interaction of humans and animals with power-frequency electric and magnetic fields
[DE86-007734] p 402 N86-31215

HUMAN CENTRIFUGES

- Assisted positive pressure breathing and modified anti-acceleration suit filling tested up to 9 G in a human centrifuge, Karolinska Institute
[FOA-C-50038-H1] p 408 N86-30341

HUMAN FACTORS ENGINEERING

- Human factors problems in the tactical air command
p 396 A86-44778
The technology impact of the Advanced Technology Crew Protection (ATCP) system on high performance aircraft
p 406 A86-44779
Medical selection and physiological training of fighter pilots: A 1985 perspective and overview
p 399 N86-30312
Activities report in perception research
[IPO-19-1984] p 405 N86-30335
Human factors activities in teleoperator development at the Oak Ridge National Laboratory
[DE86-005160] p 408 N86-30340
Pilot interaction with automated airborne decision making systems
[NASA-CR-176986] p 408 N86-31218
A discrete control model of PLANT
p 408 N86-31220

- Making the human-machine interface responsive to many classes of users
[DE86-003453] p 409 N86-31222
- Basic human factors considerations
[DE86-008181] p 409 N86-31223
- Human factors management
[DE86-008184] p 409 N86-31226
- Evaluating space station applications of automation and robotics technologies from a human productivity point of view
p 409 N86-31412

HUMAN PERFORMANCE

- The effect of spectrally selective filters on visual search performance
[AD-A165835] p 404 N86-30329
- An investigation of the use of steady-state evoked potentials for human performance and workload assessment and control
[AD-A166205] p 404 N86-30332
- The effects of color-coding in GEOSIT (geographical situational) displays. 2: Redundant versus non-redundant color-coding
[AD-A166263] p 405 N86-30334
- Activities report in perception research
[IPO-19-1984] p 405 N86-30335
- Attention tasks and their relation to aging and flight experience
[IZF-1986-4] p 405 N86-30337
- Induced erythrocythemia and maximal aerobic power: An examination of modifying factors
[AD-A166522] p 402 N86-31212
- Basic human factors considerations
[DE86-008181] p 409 N86-31223
- Impact of the human on system safety analysis
[DE86-008182] p 409 N86-31224
- Process of task analysis
[DE86-008183] p 409 N86-31225
- Human factors management
[DE86-008184] p 409 N86-31226

HUMAN RELATIONS

- Implications of privacy needs and interpersonal distancing mechanisms for space station design
[NASA-CR-176938] p 408 N86-30338

HUMIDITY

- An environmentally-controlled extended-use small animal hypobaric chamber
[AD-A166729] p 398 N86-30307
- Effects of 60 Hz electric field on operant and social stress behaviors of nonhuman primates
[DE85-016121] p 411 N86-30346

HYDROXYL COMPOUNDS

- Template-directed oligonucleotide ligation on hydroxylapatite
p 393 A86-45960

HYPEROXIA

- Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia
p 391 A86-44195

HYPERTHERMIA

- The effect of high temperature on the heat exchange and the nutritional status of pilots
p 397 A86-45325

HYPERVELOCITY IMPACT

- The viability with respect to temperature, of micro-organisms incident on the earth's atmosphere
p 410 A86-44358

HYPERVENTILATION

- The effects of cerebral hypoxia and hyperventilatory hypocapnia on the epileptiform activity in the cerebral cortex of cats
p 392 A86-45318

HYPOBARIC ATMOSPHERES

- Alteration of rat brain catecholamine levels under hypoxia
p 391 A86-43540
- An environmentally-controlled extended-use small animal hypobaric chamber
[AD-A166729] p 398 N86-30307

HYPOCAPNIA

- The effects of cerebral hypoxia and hyperventilatory hypocapnia on the epileptiform activity in the cerebral cortex of cats
p 392 A86-45318

HYPODYNAMIA

- Models of disuse - A comparison of hindlimb suspension and immobilization
p 391 A86-44196

HYPOTHALAMUS

- Neurophysiological research supporting the investigation of adaptive network architectures
[AD-A166074] p 405 N86-31216

HYPOTHERMIA

- The suppressive effect of carbon dioxide on the activation of cold receptors in the nasal cavity of cats
p 392 A86-45319

- Intrinsic alteration of the reactive properties of arteries during hypothermia
[AD-A166523] p 402 N86-31213

HYPOVOLEMIA

- Continuous blood densitometry - Fluid shifts after graded hemorrhage in animals
p 392 A86-45251

HYPOXIA

- Alteration of rat brain catecholamine levels under hypoxia
p 391 A86-43540

- The effects of cerebral hypoxia and hyperventilatory hypocapnia on the epileptiform activity in the cerebral cortex of cats
p 392 A86-45318
- The effect of hypoxia on the dynamics of the peripheral lymph flow
p 393 A86-45323
- The content of lactic acid in the blood and erythropoiesis during hypoxia
p 393 A86-45324
- Hypobaric training of flight personnel without compromising quality of life
p 401 N86-30327

ILLUSIONS

- Sensitivity to visual motion in statistically defined displays
[AD-A167291] p 405 N86-31217

IMAGE CONTRAST

- Sensitivity to color contrasts and the selection of navigator personnel
p 400 N86-30318

IMAGE PROCESSING

- Novel architectures for image processing based on computer simulation and psychophysical studies of human visual cortex
[AD-A166222] p 404 N86-30333

IMMOBILIZATION

- Models of disuse - A comparison of hindlimb suspension and immobilization
p 391 A86-44196
- The temporal response of bone to unloading
[NASA-TM-89228] p 397 N86-30303

IMMUNITY

- Flow cytometry analysis of hormone receptors on human peripheral blood mononuclear cells to identify stress-induced neuroendocrine effects
p 403 N86-31428

IMMUNOLOGY

- Biological studies of swine exposed to 60-Hz electric fields. Volume 6: Immunology
[DE86-005363] p 411 N86-30345

INDEXES (RATIOS)

- The prediction of biological activity using molecular connectivity indices
[AD-A166986] p 394 N86-31208

INFORMATION FLOW

- A discrete control model of PLANT
p 408 N86-31220

INFORMATION RETRIEVAL

- Division of attention as a function of the number of steps, visual shifts, and memory load
[NASA-TM-88775] p 404 N86-30328

INFRARED SOURCES (ASTRONOMY)

- Diatoms on earth, comets, Europa and in interstellar space
p 410 A86-44354

INJURIES

- Systematic radiographic examination of the spine for selection of F-16 pilots: A preliminary report
p 401 N86-30323

INSERTION LOSS

- Methods of measuring the attenuation of hearing protection devices
p 406 A86-45073

INTERFACES

- Impact of automation on Space Station MMI design --- Man-Machine Interface
[AIAA PAPER 86-2316] p 407 A86-46944
- Advanced operator/system interface concepts for the Space Station
[AIAA PAPER 86-2317] p 407 A86-46945

INTERSTELLAR MATTER

- Diatoms on earth, comets, Europa and in interstellar space
p 410 A86-44354

INTERVALS

- Circadian variations of systolic time intervals
p 394 A86-44087

LACTIC ACID

- The content of lactic acid in the blood and erythropoiesis during hypoxia
p 393 A86-45324

LASER APPLICATIONS

- Laser kinetic spectroscopy of unimolecular and bimolecular processes in the gas phase
[AD-A166998] p 394 N86-31209

LASER SPECTROSCOPY

- Laser kinetic spectroscopy of unimolecular and bimolecular processes in the gas phase
[AD-A166998] p 394 N86-31209

LEARNING

- Neurophysiological research supporting the investigation of adaptive network architectures
[AD-A166074] p 405 N86-31216

LIFE SCIENCES

- Space Station - Life sciences
[AIAA PAPER 86-2346] p 393 A86-46960

- Life Sciences Space Station planning document: A reference payload for the Life Sciences Research Facility
[NASA-TM-89188] p 393 N86-30302

LIFE SUPPORT SYSTEMS

- Environmental control and life support systems
p 406 A86-44534
- Environmental control/life support system for Space Station
p 407 A86-45692
- Growth evolution of the Space Station ECLSS
[AIAA PAPER 86-2313] p 407 A86-46943
- Defining reclaimed water potability requirements
p 410 N86-31422

LIGANDS

- Template-directed oligonucleotide ligation on hydroxylapatite
p 393 A86-45960

LIMBS (ANATOMY)

- Models of disuse - A comparison of hindlimb suspension and immobilization
p 391 A86-44196

LINE OF SIGHT

- Preferred declination of the line of sight
p 406 A86-45014

LONG DURATION SPACE FLIGHT

- The temporal response of bone to unloading
[NASA-TM-89228] p 397 N86-30303
- Analysis of nystagmus response to a pseudorandom velocity input
p 402 N86-31426
- Selection of an appropriate animal model for study of bone loss in weightlessness
p 412 N86-31436

LONG TERM EFFECTS

- The temporal response of bone to unloading
[NASA-TM-89228] p 397 N86-30303
- Multiparameter data acquisition systems for studies of Circadian rhythms
[DE86-004041] p 398 N86-30308

LOW TEMPERATURE

- Intrinsic alteration of the reactive properties of arteries during hypothermia
[AD-A166523] p 402 N86-31213

LUNAR SOIL

- Effects of lunar soil, Zagami meteorite, and ocean ridge basalt on the excretion of itoic acid, a siderophore, and coproporphyrin by *Bacillus subtilis*
p 412 N86-31421

LYMPH

- The effect of hypoxia on the dynamics of the peripheral lymph flow
p 393 A86-45323

M**MAGNETIC FIELDS**

- Physical interaction of humans and animals with power-frequency electric and magnetic fields
[DE86-007734] p 402 N86-31215

MAINTENANCE

- Human factors activities in teleoperator development at the Oak Ridge National Laboratory
[DE86-005160] p 408 N86-30340

MALES

- Metabolic changes following eccentric exercise in trained and untrained men
[AD-A166521] p 402 N86-31211

MALFUNCTIONS

- Flow cytometry analysis of hormone receptors on human peripheral blood mononuclear cells to identify stress-induced neuroendocrine effects
p 403 N86-31428

MAN MACHINE SYSTEMS

- Detection of system failure by human operator. I - The case of monitor
p 403 A86-43535
- Intelligent crew workstations
p 406 A86-44532
- Visual accommodation and virtual image displays - Target detection and recognition
p 406 A86-45015
- Experimental estimate of the parameters of a stochastic model of a human operator sensor system
p 407 A86-45117

- Growth evolution of the Space Station ECLSS
[AIAA PAPER 86-2313] p 407 A86-46943

- Impact of automation on Space Station MMI design --- Man-Machine Interface
[AIAA PAPER 86-2316] p 407 A86-46944

- Advanced operator/system interface concepts for the Space Station
[AIAA PAPER 86-2317] p 407 A86-46945

- Pilot interaction with automated airborne decision making systems
[NASA-CR-176986] p 408 N86-31218

- A discrete control model of PLANT
p 408 N86-31220

- Making the human-machine interface responsive to many classes of users
[DE86-003453] p 409 N86-31222

MANNED SPACE FLIGHT

- Analysis of nystagmus response to a pseudorandom velocity input
p 402 N86-31426

- Selection of an appropriate animal model for study of bone loss in weightlessness p 412 N86-31436
- MARS (PLANET)**
The question of life on Mars p 410 A86-43927
- MATHEMATICAL MODELS**
An updated model for a Space Station Health Maintenance Facility [AIAA PAPER 86-2303] p 397 A86-46938
Physical interaction of humans and animals with power-frequency electric and magnetic fields [DE86-007734] p 402 N86-31215
A discrete control model of PLANT p 408 N86-31220
- MEDICAL ELECTRONICS**
Specifications Physiological Monitoring System [NASA-CR-171926] p 408 N86-30339
- MEDICAL EQUIPMENT**
Specifications Physiological Monitoring System [NASA-CR-171926] p 408 N86-30339
- MEDICAL SERVICES**
Air ambulance regulations - A model p 405 A86-44094
- MEMORY**
Division of attention as a function of the number of steps, visual shifts, and memory load [NASA-TM-88775] p 404 N86-30328
- MENTAL PERFORMANCE**
Review on secondary task technique for workload assessment Some consideration of secondary task paradigms and an assessment model p 403 A86-43539
- METABOLISM**
Metabolic changes following eccentric exercise in trained and untrained men [AD-A166521] p 402 N86-31211
- METEORITES**
Effects of lunar soil, Zagami meteorite, and ocean ridge basalt on the excretion of itoic acid, a siderophore, and coproporphyrin by *Bacillus subtilis* p 412 N86-31421
- MICE**
Effects of simulated weightlessness on meiosis. Fertilization, and early development in mice [NASA-CR-177106] p 410 N86-30342
- MICROBIOLOGY**
Advantages of the gas exchange approach to microbiological studies [AD-A166887] p 393 N86-31207
- MICROORGANISMS**
The viability with respect to temperature, of micro-organisms incident on the earth's atmosphere p 410 A86-44358
- MICROWAVE EMISSION**
Radiofrequencies and microwaves - Radiation safety of the operator p 397 A86-46270
- MICROWAVES**
Assessing possible damage due to radio frequency radiation [AD-A166913] p 402 N86-31214
- MILKY WAY GALAXY**
Diatoms on earth, comets, Europa and in interstellar space p 410 A86-44354
- MINERALS**
Template-directed oligonucleotide ligation on hydroxylapatite p 393 A86-45960
- MIRAGE AIRCRAFT**
Physical training of Mirage 2000 pilots p 401 N86-30324
- MIXING**
How well mixed is inert gas in tissues? p 391 A86-44197
- MOLECULAR BIOLOGY**
The photobiological aspects of radiation damage in cells --- Russian book p 392 A86-44295
The prediction of biological activity using molecular connectivity indices [AD-A166986] p 394 N86-31208
- MOLECULAR STRUCTURE**
The prediction of biological activity using molecular connectivity indices [AD-A166986] p 394 N86-31208
- MONITORS**
Division of attention as a function of the number of steps, visual shifts, and memory load [NASA-TM-88775] p 404 N86-30328
- MONTE CARLO METHOD**
Pilot interaction with automated airborne decision making systems [NASA-CR-176986] p 408 N86-31218
- MOTION PERCEPTION**
Sensitivity to visual motion in statistically defined displays [AD-A167291] p 405 N86-31217
- MOTION SICKNESS**
Analysis of nystagmus response to a pseudorandom velocity input p 402 N86-31426

MOTION SICKNESS DRUGS

- Naloxone enhances motion sickness - Endorphins implicated p 395 A86-44088

MUSCLES

- A possible role for endogenous glucocorticoids in orchietomy-induced atrophy of the rat levator ani muscle: Studies with RU38486, a potent and selective antiglucocorticoid [NASA-CR-177029] p 411 N86-30343
Intrinsic alteration of the reactive properties of arteries during hypothermia [AD-A166523] p 402 N86-31213

MUSCULAR FUNCTION

- Inhibitory effects of combined agonist and antagonist muscle vibration on H-reflex in man p 395 A86-44090
Models of disuse - A comparison of hindlimb suspension and immobilization p 391 A86-44196
Changes in pericardial microcirculation in dogs during adaptation to static muscle loads p 392 A86-45321

MUSCULOSKELETAL SYSTEM

- Flow cytometry analysis of hormone receptors on human peripheral blood mononuclear cells to identify stress-induced neuroendocrine effects p 403 N86-31428

MYOCARDIUM

- The contractile function and the energy metabolism of the myocardium under emotional stress and during adaptation of animals to short stress effects p 392 A86-45322

N**NAVIGATORS**

- Sensitivity to color contrasts and the selection of navigator personnel p 400 N86-30318

NAVY

- Relationship of cardiopulmonary fitness to flight performance in tactical aviation p 401 N86-30326
Hypobaric training of flight personnel without compromising quality of life p 401 N86-30327

NEBULAE

- Diatoms on earth, comets, Europa and in interstellar space p 410 A86-44354

NEUROMUSCULAR TRANSMISSION

- Neurophysiological research supporting the investigation of adaptive network architectures [AD-A166074] p 405 N86-31216

NEURONS

- Correlations between the levels of cerebral blood flow and cerebrovascular reactivity and the functional state of brain tissue p 392 A86-45320
Neurophysiological research supporting the investigation of adaptive network architectures [AD-A166074] p 405 N86-31216

NEUROPHYSIOLOGY

- Naloxone enhances motion sickness - Endorphins implicated p 395 A86-44088
The effects of cerebral hypoxia and hyperventilatory hypocapnia on the epileptiform activity in the cerebral cortex of cats p 392 A86-45318
Neurophysiological research supporting the investigation of adaptive network architectures [AD-A166074] p 405 N86-31216

NOISE REDUCTION

- Methods of measuring the attenuation of hearing protection devices p 406 A86-45073

NOSE (ANATOMY)

- The suppressive effect of carbon dioxide on the activation of cold receptors in the nasal cavity of cats p 392 A86-45319

NUCLEAR FUEL REPROCESSING

- Human factors activities in teleoperator development at the Oak Ridge National Laboratory [DE86-005160] p 408 N86-30340

NUCLEOTIDES

- Template-directed oligonucleotide ligation on hydroxylapatite p 393 A86-45960

NUTRITIONAL REQUIREMENTS

- The effect of high temperature on the heat exchange and the nutritional status of pilots p 397 A86-45325

O**OCULOMOTOR NERVES**

- Computer analysis of visual and vestibular oculomotor function in the medical selection of fighter aircrew members p 400 N86-30319

OPERATOR PERFORMANCE

- Detection of system failure by human operator. I - The case of monitor p 403 A86-43535
Review on secondary task technique for workload assessment Some consideration of secondary task paradigms and an assessment model p 403 A86-43539

- Experimental estimate of the parameters of a stochastic model of a human operator sensor system p 407 A86-45117

OPHTHALMOLOGY

- Sensitivity to color contrasts and the selection of navigator personnel p 400 N86-30318

OPTICAL FILTERS

- The effect of spectrally selective filters on visual search performance [AD-A165835] p 404 N86-30329

ORBITAL SERVICING

- Advanced space suit development for future on-orbit operations [AIAA PAPER 86-2310] p 407 A86-46941

ORBITAL SPACE STATIONS

- Zero-G simulation verifies EVA servicing of space station modules [AIAA PAPER 86-2312] p 407 A86-46942

OXYGEN

- An environmentally-controlled extended-use small animal hypobaric chamber [AD-A166729] p 398 N86-30307

OXYGEN BREATHING

- The effect of breathing elevated CO₂ gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz [AD-A165974] p 401 N86-31210

P**PAIN**

- Low back pain in pilots p 395 A86-44092

PARAMETER IDENTIFICATION

- Experimental estimate of the parameters of a stochastic model of a human operator sensor system p 407 A86-45117

PERCEPTION

- Experimental estimate of the parameters of a stochastic model of a human operator sensor system p 407 A86-45117
Activities report in perception research [IPO-19-1984] p 405 N86-30335

PERFORMANCE PREDICTION

- Detection of system failure by human operator. I - The case of monitor p 403 A86-43535

PERFORMANCE TESTS

- Zero-G simulation verifies EVA servicing of space station modules [AIAA PAPER 86-2312] p 407 A86-46942

PERIPHERAL CIRCULATION

- The effect of hypoxia on the dynamics of the peripheral lymph flow p 393 A86-45323

PERMEABILITY

- Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia p 391 A86-44195

PERSONNEL

- Process of task analysis [DE86-008183] p 409 N86-31225
Human factors management [DE86-008184] p 409 N86-31226

PERSONNEL MANAGEMENT

- Human factors management [DE86-008184] p 409 N86-31226

PERSONNEL SELECTION

- Canadian forces approach to aircrew medical selection p 399 N86-30311
Cardiovascular standards for selection and retention of high performance pilots in the USAF: Perspectives for the next decade p 399 N86-30313
Entry visual standards and ocular examination techniques for future fighter aircrew p 400 N86-30317
Sensitivity to color contrasts and the selection of navigator personnel p 400 N86-30318
Computer analysis of visual and vestibular oculomotor function in the medical selection of fighter aircrew members p 400 N86-30319

PHARMACOLOGY

- The prediction of biological activity using molecular connectivity indices [AD-A166986] p 394 N86-31208

PHOTODISSOCIATION

- Laser kinetic spectroscopy of unimolecular and bimolecular processes in the gas phase [AD-A166998] p 394 N86-31209

PHYSICAL CHEMISTRY

- The prediction of biological activity using molecular connectivity indices [AD-A166986] p 394 N86-31208

PHYSICAL EXAMINATIONS

- Canadian forces approach to aircrew medical selection p 399 N86-30311
Medical selection and physiological training of fighter pilots: A 1985 perspective and overview p 399 N86-30312

Cardiovascular standards for selection and retention of high performance pilots in the USAF: Perspectives for the next decade p 399 N86-30313

Selection and medical testing of Mirage 2000 pilots: Report of echocardiography p 399 N86-30314

Systematic radiographic examination of the spine for selection of F-16 pilots: A preliminary report p 401 N86-30323

Treadmill spirometry in the selection and screening of high-performance combat aircraft pilots in the Belgian Air Force p 401 N86-30325

PHYSICAL EXERCISE

Physical training and + Gz tolerance reevaluated p 396 A86-44096

Metabolic changes following eccentric exercise in trained and untrained men [AD-A166521] p 402 N86-31211

PHYSICAL FITNESS

Medical Selection and Physiological Training of Future Fighter Aircrew [AGARD-CP-396] p 398 N86-30309

Physical training of Mirage 2000 pilots p 401 N86-30324

Relationship of cardiopulmonary fitness to flight performance in tactical aviation p 401 N86-30326

Metabolic changes following eccentric exercise in trained and untrained men [AD-A166521] p 402 N86-31211

Induced erythrocythemia and maximal aerobic power: An examination of modifying factors [AD-A166522] p 402 N86-31212

PHYSIOCHEMISTRY

Naloxone enhances motion sickness - Endorphins implicated p 395 A86-44088

The contractile function and the energy metabolism of the myocardium under emotional stress and during adaptation of animals to short stress effects p 392 A86-45322

PHYSIOLOGICAL ACCELERATION

Single sinusoids compared with a multiple-sinusoids technique for evaluating horizontal semicircular canal function p 395 A86-44089

PHYSIOLOGICAL EFFECTS

Inhibitory effects of combined agonist and antagonist muscle vibration on H-reflex in man p 395 A86-44090

The temporal response of bone to unloading [NASA-TM-89228] p 397 N86-30303

Aircrew aspects of United States future fighter aircraft p 398 N86-30310

A possible role for endogenous glucocorticoids in orchietomy-induced atrophy of the rat levator ani muscle: Studies with RU38486, a potent and selective antiglucocorticoid [NASA-CR-177029] p 411 N86-30343

Analysis of nystagmus response to a pseudorandom velocity input p 402 N86-31426

PHYSIOLOGICAL RESPONSES

The role of gravity in producing digestive system changes p 391 A86-43677

Effect of head-out water immersion on response to exercise training p 396 A86-44194

The photobiological aspects of radiation damage in cells --- Russian book p 392 A86-44295

Thermoregulation after atropine and pralidoxime administration [AD-A165868] p 397 N86-30304

Human vascular fluid responses to cold stress are not altered by cold acclimation [AD-A165869] p 398 N86-30305

Hypobaric training of flight personnel without compromising quality of life p 401 N86-30327

Assessing possible damage due to radio frequency radiation [AD-A166913] p 402 N86-31214

Neurophysiological research supporting the investigation of adaptive network architectures [AD-A166074] p 405 N86-31216

PHYSIOLOGICAL TESTS

Canadian forces approach to aircrew medical selection p 399 N86-30311

PHYSIOLOGY

Specifications Physiological Monitoring System [NASA-CR-171926] p 408 N86-30339

PILOT PERFORMANCE

Low back pain in pilots p 395 A86-44092

Diffuse pulmonary ossification and spontaneous pneumothorax in a pilot - A case report p 395 A86-44093

Simulated aerial combat maneuvering tolerance and physical conditioning - Current status p 396 A86-44097

G-induced loss of consciousness - Combat aircraft pilots head for trouble p 396 A86-44814

The effect of high temperature on the heat exchange and the nutritional status of pilots p 397 A86-45325

Aircrew aspects of United States future fighter aircraft p 398 N86-30310

Vision test battery threshold and response time as predictors of air-to-air visual target acquisition in F-14 and adversary aircraft p 400 N86-30321

Relationship of cardiopulmonary fitness to flight performance in tactical aviation p 401 N86-30326

The importance of specialized cognitive function in the selection of military pilots [AD-A165889] p 404 N86-30330

The effect of breathing elevated CO2 gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz [AD-A165974] p 401 N86-31210

PILOT SELECTION

Medical Selection and Physiological Training of Future Fighter Aircrew [AGARD-CP-396] p 398 N86-30309

Selection and medical testing of Mirage 2000 pilots: Report of echocardiography p 399 N86-30314

The vertebral column: Selection and aptitude of combat aircraft pilots of the future p 400 N86-30322

Systematic radiographic examination of the spine for selection of F-16 pilots: A preliminary report p 401 N86-30323

Treadmill spirometry in the selection and screening of high-performance combat aircraft pilots in the Belgian Air Force p 401 N86-30325

The importance of specialized cognitive function in the selection of military pilots [AD-A165889] p 404 N86-30330

PILOT TRAINING

The significance of recurrent childhood respiratory disorders in flight training applicants p 395 A86-44095

The importance of specialized cognitive function in the selection of military pilots [AD-A165889] p 404 N86-30330

PNEUMOTHORAX

Diffuse pulmonary ossification and spontaneous pneumothorax in a pilot - A case report p 395 A86-44093

POLYMER CHEMISTRY

Template-directed oligonucleotide ligation on hydroxylapatite p 393 A86-45960

PORPHYRINS

Effects of lunar soil, Zagami meteorite, and ocean ridge basalt on the excretion of itoic acid, a siderophore, and coproporphyrin by *Bacillus subtilis* p 412 N86-31421

PORTABLE EQUIPMENT

Specifications Physiological Monitoring System [NASA-CR-171926] p 408 N86-30339

POSITION (LOCATION)

Spatiotemporal characteristics of visual localization [AD-A166097] p 404 N86-30331

POTABLE WATER

Development of thermoelectric water heating-cooling devices [AD-A166949] p 409 N86-31221

Defining reclaimed water potability requirements p 410 N86-31422

PREDICTIONS

The use of ECG changes caused by acceleration as tolerance prediction factors p 399 N86-30316

PRESSURE BREATHING

Assisted positive pressure breathing and modified anti-acceleration suit filling tested up to 9 G in a human centrifuge, Karolinska Institute [FOA-C-50038-H1] p 408 N86-30341

PRESSURE CHAMBERS

An environmentally-controlled extended-use small animal hypobaric chamber [AD-A166729] p 398 N86-30307

PRESSURE SUITS

The technology impact of the Advanced Technology Crew Protection (ATCP) system on high performance aircraft p 406 A86-44779

Assisted positive pressure breathing and modified anti-acceleration suit filling tested up to 9 G in a human centrifuge, Karolinska Institute [FOA-C-50038-H1] p 408 N86-30341

PRIVACY

Implications of privacy needs and interpersonal distancing mechanisms for space station design [NASA-CR-176938] p 408 N86-30338

PROBABILITY THEORY

Impact of the human on system safety analysis [DE86-008182] p 409 N86-31224

PROBLEM SOLVING

Representation for closed form significance testing in VL1 p 408 N86-31219

A discrete control model of PLANT p 408 N86-31220

PROGENY

Biological studies of swine exposed to 60-Hz electric fields. Volume 5: Hematology and serum chemistry [DE86-005362] p 411 N86-30344

PROPHYLAXIS

Theoretical principles underlying the evaluation, control, and correction of the impact of emotions on cosmonaut activity p 403 A86-44601

PROSTAGLANDINS

The possible involvement of PGI2 in the PEEP-induced changes in cardiac output and blood pressure p 395 A86-44091

PROTEIN SYNTHESIS

Template-directed oligonucleotide ligation on hydroxylapatite p 393 A86-45960

PSYCHOLOGICAL EFFECTS

Aircrew aspects of United States future fighter aircraft p 398 N86-30310

PSYCHOLOGICAL TESTS

Canadian forces approach to aircrew medical selection p 399 N86-30311

Attention tasks and their relation to aging and flight experience [IZF-1986-4] p 405 N86-30337

PSYCHOPHYSICS

Spatiotemporal characteristics of visual localization [AD-A166097] p 404 N86-30331

Novel architectures for image processing based on computer simulation and psychophysical studies of human visual cortex [AD-A166222] p 404 N86-30333

Sensitivity to visual motion in statistically defined displays [AD-A167291] p 405 N86-31217

PSYCHOPHYSIOLOGY

Theoretical principles underlying the evaluation, control, and correction of the impact of emotions on cosmonaut activity p 403 A86-44601

PULMONARY FUNCTIONS

Treadmill spirometry in the selection and screening of high-performance combat aircraft pilots in the Belgian Air Force p 401 N86-30325

Relationship of cardiopulmonary fitness to flight performance in tactical aviation p 401 N86-30326

PULMONARY LESIONS

Diffuse pulmonary ossification and spontaneous pneumothorax in a pilot - A case report p 395 A86-44093

R**RABBITS**

Intrinsic alteration of the reactive properties of arteries during hypothermia [AD-A166523] p 402 N86-31213

RADIATION DAMAGE

The photobiological aspects of radiation damage in cells --- Russian book p 392 A86-44295

RADIATION DOSAGE

Radiofrequencies and microwaves - Radiation safety of the operator p 397 A86-46270

Bacterial inactivation by means of ionizing radiation [DE86-901036] p 412 N86-30348

Cytogenetic analyses of peripheral lymphocytes subjected to simulated solar flare radiation p 412 N86-31431

RADIATION HAZARDS

Assessing possible damage due to radio frequency radiation [AD-A166913] p 402 N86-31214

RADIATION PROTECTION

Radiofrequencies and microwaves - Radiation safety of the operator p 397 A86-46270

RADIATION TOLERANCE

Radiofrequencies and microwaves - Radiation safety of the operator p 397 A86-46270

RADIO FREQUENCIES

Radiofrequencies and microwaves - Radiation safety of the operator p 397 A86-46270

RADIO WAVES

Assessing possible damage due to radio frequency radiation [AD-A166913] p 402 N86-31214

RADIOBIOLOGY

The photobiological aspects of radiation damage in cells --- Russian book p 392 A86-44295

RADIOGRAPHY

Systematic radiographic examination of the spine for selection of F-16 pilots: A preliminary report p 401 N86-30323

RARE GASES

How well mixed is inert gas in tissues? p 391 A86-44197

RATS

The temporal response of bone to unloading [NASA-TM-89228] p 397 N86-30303

Multiparameter data acquisition systems for studies of Circadian rhythms [DE86-004041] p 398 N86-30308

REACTION KINETICS

- Laser kinetic spectroscopy of unimolecular and bimolecular processes in the gas phase
[AD-A166998] p 394 N86-31209

REACTION TIME

- Vision test battery threshold and response time as predictors of air-to-air visual target acquisition in F-14 and adversary aircraft p 400 N86-30321

REDUCED GRAVITY

- Effects of simulated weightlessness on meiosis. Fertilization, and early development in mice
[NASA-CR-177106] p 410 N86-30342

REGRESSION ANALYSIS

- Effects of 60 Hz electric field on operant and social stress behaviors of nonhuman primates
[DE85-016121] p 411 N86-30346

RELIABILITY ANALYSIS

- Impact of the human on system safety analysis
[DE86-008182] p 409 N86-31224

RESEARCH

- Cognitive aspects of command and control
[IZF-1986-2] p 405 N86-30336

RESEARCH MANAGEMENT

- Life Sciences Space Station planning document: A reference payload for the Life Sciences Research Facility
[NASA-TM-89188] p 393 N86-30302

RESPIRATORY DISEASES

- Diffuse pulmonary ossification and spontaneous pneumothorax in a pilot - A case report p 395 A86-44093

- The significance of recurrent childhood respiratory disorders in flight training applicants p 395 A86-44095

RESPIRATORY PHYSIOLOGY

- The possible involvement of PGI₂ in the PEEP-induced changes in cardiac output and blood pressure p 395 A86-44091
- Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia p 391 A86-44195
- The suppressive effect of carbon dioxide on the activation of cold receptors in the nasal cavity of cats p 392 A86-45319
- Correlations between the levels of cerebral blood flow and cerebrovascular reactivity and the functional state of brain tissue p 392 A86-45320

RESPIRATORY RATE

- The effect of breathing elevated CO₂ gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz
[AD-A165974] p 401 N86-31210

RISK

- Impact of the human on system safety analysis
[DE86-008182] p 409 N86-31224

ROBOTICS

- Advanced operator/system interface concepts for the Space Station
[AIAA PAPER 86-2317] p 407 A86-46945
- Evaluating space station applications of automation and robotics technologies from a human productivity point of view p 409 N86-31412

S

SAFETY

- Impact of the human on system safety analysis
[DE86-008182] p 409 N86-31224

SAFETY DEVICES

- The technology impact of the Advanced Technology Crew Protection (ATCP) system on high performance aircraft p 406 A86-44779

SAFETY MANAGEMENT

- Radiofrequencies and microwaves - Radiation safety of the operator p 397 A86-46270

SEAMOUNTS

- Effects of lunar soil, Zagami meteorite, and ocean ridge basalt on the excretion of itoic acid, a siderophore, and coproporphyrin by *Bacillus subtilis* p 412 N86-31421

SELF ORGANIZING SYSTEMS

- Neurophysiological research supporting the investigation of adaptive network architectures
[AD-A166074] p 405 N86-31216

SEMICIRCULAR CANALS

- Single sinusoids compared with a multiple-sinusoids technique for evaluating horizontal semicircular canal function p 395 A86-44089

SENSORIMOTOR PERFORMANCE

- Inhibitory effects of combined agonist and antagonist muscle vibration on H-reflex in man p 395 A86-44090

SERVICE MODULES

- Zero-G simulation verifies EVA servicing of space station modules
[AIAA PAPER 86-2312] p 407 A86-46942

SHAPES

- Novel architectures for image processing based on computer simulation and psychophysical studies of human visual cortex
[AD-A166222] p 404 N86-30333

SIGNAL ANALYSIS

- The inverse problem in electrocardiography - A model study of the effects of geometry and conductivity parameters on the reconstruction of epicardial potentials p 394 A86-43750

SIMULATION

- An investigation of the use of steady-state evoked potentials for human performance and workload assessment and control
[AD-A166205] p 404 N86-30332

SKIN TEMPERATURE (BIOLOGY)

- Thermoregulation after atropine and pralidoxime administration
[AD-A165868] p 397 N86-30304

SOCIAL FACTORS

- Implications of privacy needs and interpersonal distancing mechanisms for space station design
[NASA-CR-176938] p 408 N86-30338

SOCIAL ISOLATION

- Implications of privacy needs and interpersonal distancing mechanisms for space station design
[NASA-CR-176938] p 408 N86-30338

SOFTWARE ENGINEERING

- Pilot interaction with automated airborne decision making systems
[NASA-CR-176986] p 408 N86-31218

SOLAR FLARES

- Cytogenetic analyses of peripheral lymphocytes subjected to simulated solar flare radiation p 412 N86-31431

SOLAR PROTONS

- Cytogenetic analyses of peripheral lymphocytes subjected to simulated solar flare radiation p 412 N86-31431

SOLUTES

- Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia p 391 A86-44195

SPACE ADAPTATION SYNDROME

- Analysis of nystagmus response to a pseudorandom velocity input p 402 N86-31426
- Flow cytometry analysis of hormone receptors on human peripheral blood mononuclear cells to identify stress-induced neuroendocrine effects p 403 N86-31428
- Selection of an appropriate animal model for study of bone loss in weightlessness p 412 N86-31436

SPACE EXPLORATION

- The question of life on Mars p 410 A86-43927

SPACE MAINTENANCE

- Advanced space suit development for future on-orbit operations
[AIAA PAPER 86-2310] p 407 A86-46941
- Zero-G simulation verifies EVA servicing of space station modules
[AIAA PAPER 86-2312] p 407 A86-46942

SPACE PERCEPTION

- Spatiotemporal characteristics of visual localization
[AD-A166097] p 404 N86-30331
- Sensitivity to visual motion in statistically defined displays
[AD-A167291] p 405 N86-31217

SPACE PSYCHOLOGY

- Theoretical principles underlying the evaluation, control, and correction of the impact of emotions on cosmonaut activity p 403 A86-44601
- Implications of privacy needs and interpersonal distancing mechanisms for space station design
[NASA-CR-176938] p 408 N86-30338

SPACE SHUTTLE PAYLOADS

- Life Sciences Space Station planning document: A reference payload for the Life Sciences Research Facility
[NASA-TM-89188] p 393 N86-30302

SPACE STATIONS

- Intelligent crew workstations p 406 A86-44532
- Environmental control/life support system for Space Station p 407 A86-45692
- An updated model for a Space Station Health Maintenance Facility
[AIAA PAPER 86-2303] p 397 A86-46938
- Growth evolution of the Space Station ECLSS
[AIAA PAPER 86-2313] p 407 A86-46943
- Impact of automation on Space Station MMI design --- Man-Machine Interface
[AIAA PAPER 86-2316] p 407 A86-46944
- Advanced operator/system interface concepts for the Space Station
[AIAA PAPER 86-2317] p 407 A86-46945
- Space Station - Life sciences
[AIAA PAPER 86-2346] p 393 A86-46960

- Life Sciences Space Station planning document: A reference payload for the Life Sciences Research Facility
[NASA-TM-89188] p 393 N86-30302
- Evaluating space station applications of automation and robotics technologies from a human productivity point of view p 409 N86-31412
- Cytogenetic analyses of peripheral lymphocytes subjected to simulated solar flare radiation p 412 N86-31431

SPACE SUITS

- Advanced space suit development for future on-orbit operations
[AIAA PAPER 86-2310] p 407 A86-46941

SPACEBORNE EXPERIMENTS

- Space Station - Life sciences
[AIAA PAPER 86-2346] p 393 A86-46960

SPACECRAFT CABIN ATMOSPHERES

- Environmental control and life support systems p 406 A86-44534

SPACECRAFT DESIGN

- Environmental control and life support systems p 406 A86-44534
- Environmental control/life support system for Space Station p 407 A86-45692
- Growth evolution of the Space Station ECLSS
[AIAA PAPER 86-2313] p 407 A86-46943
- Impact of automation on Space Station MMI design --- Man-Machine Interface
[AIAA PAPER 86-2316] p 407 A86-46944

SPACECRAFT ENVIRONMENTS

- Environmental control and life support systems p 406 A86-44534
- Environmental control/life support system for Space Station p 407 A86-45692

SPACECREWS

- Specifications Physiological Monitoring System
[NASA-CR-171926] p 408 N86-30339
- Cytogenetic analyses of peripheral lymphocytes subjected to simulated solar flare radiation p 412 N86-31431

SPECIFICATIONS

- Defining reclaimed water potability requirements p 410 N86-31422

SPECTRAL SENSITIVITY

- The effect of spectrally selective filters on visual search performance
[AD-A165835] p 404 N86-30329

STANDARDS

- Canadian forces approach to aircrew medical selection p 399 N86-30311
- Cardiovascular standards for selection and retention of high performance pilots in the USAF: Perspectives for the next decade p 399 N86-30313
- Entry visual standards and ocular examination techniques for future fighter aircrew p 400 N86-30317

STATISTICAL DISTRIBUTIONS

- Laser kinetic spectroscopy of unimolecular and bimolecular processes in the gas phase
[AD-A166998] p 394 N86-31209

STERILIZATION

- Bacterial inactivation by means of ionizing radiation
[DE86-901038] p 412 N86-30348

STOCHASTIC PROCESSES

- Experimental estimate of the parameters of a stochastic model of a human operator sensor system p 407 A86-45117

STRESS (PHYSIOLOGY)

- Changes in pericardial microcirculation in dogs during adaptation to static muscle loads p 392 A86-45321
- Human vascular fluid responses to cold stress are not altered by cold acclimation p 398 N86-30305

- An environmentally-controlled extended-use small animal hypobaric chamber
[AD-A166729] p 398 N86-30307

- Effects of 60 Hz electric fields on operant and social stress behaviors of nonhuman primates
[DE86-005807] p 411 N86-30347

- Metabolic changes following eccentric exercise in trained and untrained men
[AD-A166521] p 402 N86-31211

STRESS (PSYCHOLOGY)

- Review on secondary task technique for workload assessment Some consideration of secondary task paradigms and an assessment model p 403 A86-43539

- The contractile function and the energy metabolism of the myocardium under emotional stress and during adaptation of animals to short stress effects p 392 A86-45322

- Effects of 60 Hz electric fields on operant and social stress behaviors of nonhuman primates
[DE86-005807] p 411 N86-30347

SUBJECT INDEX

STROBOSCOPES

Sensitivity to visual motion in statistically defined displays
[AD-A167291] p 405 N86-31217

SUBMARINES

Calcium and vitamin D metabolism in submariners: Carbon dioxide, sunlight and absorption considerations
[AD-A166292] p 398 N86-30306

SUNLIGHT

Calcium and vitamin D metabolism in submariners: Carbon dioxide, sunlight and absorption considerations
[AD-A166292] p 398 N86-30306

SUSPENDING (HANGING)

Models of disuse - A comparison of hindlimb suspension and immobilization p 391 A86-44196

SWINE

Biological studies of swine exposed to 60-Hz electric fields. Volume 5: Hematology and serum chemistry
[DE86-005362] p 411 N86-30344

SYNTAX

Representation for closed form significance testing in VL1 p 408 N86-31219

SYSTEM FAILURES

Detection of system failure by human operator. I - The case of monitor p 403 A86-43535

SYSTEMS ANALYSIS

Basic human factors considerations
[DE86-008181] p 409 N86-31223

SYSTOLE

Circadian variations of systolic time intervals p 394 A86-44087

T

TARGET RECOGNITION

Visual accommodation and virtual image displays - Target detection and recognition p 406 A86-45015

TARGETS

Preferred declination of the line of sight p 406 A86-45014
The effects of color-coding in GEOSIT (geographical situational) displays. 2: Redundant versus non-redundant color-coding
[AD-A166263] p 405 N86-30334

TASK COMPLEXITY

Detection of system failure by human operator. I - The case of monitor p 403 A86-43535
Review on secondary task technique for workload assessment Some consideration of secondary task paradigms and an assessment model p 403 A86-43539

Visual accommodation and virtual image displays - Target detection and recognition p 406 A86-45015

TASKS

Visual capabilities related to fighter aircrew performance in the F-14 and adversary aircraft p 400 N86-30320
An investigation of the use of steady-state evoked potentials for human performance and workload assessment and control
[AD-A166205] p 404 N86-30332
Basic human factors considerations
[DE86-008181] p 409 N86-31223
Process of task analysis
[DE86-008183] p 409 N86-31225

TECHNOLOGY ASSESSMENT

The technology impact of the Advanced Technology Crew Protection (ATCP) system on high performance aircraft p 406 A86-44779

TELEOPERATORS

Human factors activities in teleoperator development at the Oak Ridge National Laboratory
[DE86-005160] p 408 N86-30340

TEMPERATURE EFFECTS

The effect of high temperature on the heat exchange and the nutritional status of pilots p 397 A86-45325

TEST CHAMBERS

Hypobaric training of flight personnel without compromising quality of life p 401 N86-30327

THERMOELECTRIC COOLING

Development of thermoelectric water heating-cooling devices
[AD-A166949] p 409 N86-31221

THERMORECEPTORS

The suppressive effect of carbon dioxide on the activation of cold receptors in the nasal cavity of cats p 392 A86-45319

THERMOREGULATION

Thermoregulation after atropine and pralidoxime administration
[AD-A165868] p 397 N86-30304

TISSUES (BIOLOGY)

How well mixed is inert gas in tissues? p 391 A86-44197

TOLERANCES (PHYSIOLOGY)

Human vascular fluid responses to cold stress are not altered by cold acclimation
[AD-A165869] p 398 N86-30305

An environmentally-controlled extended-use small animal hypobaric chamber
[AD-A166729] p 398 N86-30307

TOXICOLOGY

The prediction of biological activity using molecular connectivity indices
[AD-A166986] p 394 N86-31208

TRACKING (POSITION)

Computer analysis of visual and vestibular oculomotor function in the medical selection of fighter aircrew members p 400 N86-30319

TRAINING EVALUATION

Physical training of Mirage 2000 pilots p 401 N86-30324

TRANSMISSION LOSS

Methods of measuring the attenuation of hearing protection devices p 406 A86-45073

U

ULTRAVIOLET ABSORPTION

Calcium and vitamin D metabolism in submariners: Carbon dioxide, sunlight and absorption considerations
[AD-A166292] p 398 N86-30306

UNCONSCIOUSNESS

G-induced loss of consciousness - Combat aircraft pilots head for trouble p 396 A86-44814

USER REQUIREMENTS

Making the human-machine interface responsive to many classes of users
[DE86-003453] p 409 N86-31222

V

VACUUM CHAMBERS

An environmentally-controlled extended-use small animal hypobaric chamber
[AD-A166729] p 398 N86-30307

VAPOR PHASES

Laser kinetic spectroscopy of unimolecular and bimolecular processes in the gas phase
[AD-A166998] p 394 N86-31209

VASCULAR SYSTEM

Correlations between the levels of cerebral blood flow and cerebrovascular reactivity and the functional state of brain tissue p 392 A86-45320

VASOCONSTRICTION

Intrinsic alteration of the reactive properties of arteries during hypothermia
[AD-A166523] p 402 N86-31213

VENTILATION

An environmentally-controlled extended-use small animal hypobaric chamber
[AD-A166729] p 398 N86-30307

VERTEBRAL COLUMN

The vertebral column: Selection and aptitude of combat aircraft pilots of the future p 400 N86-30322
Systematic radiographic examination of the spine for selection of F-16 pilots: A preliminary report p 401 N86-30323

VESTIBULAR NYSTAGMUS

Analysis of nystagmus response to a pseudorandom velocity input p 402 N86-31426

VIABILITY

The viability with respect to temperature, of micro-organisms incident on the earth's atmosphere p 410 A86-44358

VIBRATION EFFECTS

Inhibitory effects of combined agonist and antagonist muscle vibration on H-reflex in man p 395 A86-44090

VIKING LANDER SPACECRAFT

The question of life on Mars p 410 A86-43927

VISIBLE SPECTRUM

The photobiological aspects of radiation damage in cells --- Russian book p 392 A86-44295

VISION

Spatiotemporal characteristics of visual localization
[AD-A166097] p 404 N86-30331

VISUAL ACCOMMODATION

Visual accommodation and virtual image displays - Target detection and recognition p 406 A86-45015

VISUAL ACUITY

Entry visual standards and ocular examination techniques for future fighter aircrew p 400 N86-30317
The effect of spectrally selective filters on visual search performance
[AD-A165835] p 404 N86-30329

VISUAL AIDS

Entry visual standards and ocular examination techniques for future fighter aircrew p 400 N86-30317

WORKLOADS (PSYCHOPHYSIOLOGY)

VISUAL DISCRIMINATION

Preferred declination of the line of sight p 406 A86-45014
Enhanced detection in the aperture of focal attention during simple discrimination tasks p 403 A86-45955
Entry visual standards and ocular examination techniques for future fighter aircrew p 400 N86-30317

VISUAL FIELDS

Enhanced detection in the aperture of focal attention during simple discrimination tasks p 403 A86-45955

VISUAL PERCEPTION

Medical Selection and Physiological Training of Future

Fighter Aircrew

[AGARD-CP-396] p 398 N86-30309

Computer analysis of visual and vestibular oculomotor function in the medical selection of fighter aircrew members p 400 N86-30319

Visual capabilities related to fighter aircrew performance in the F-14 and adversary aircraft p 400 N86-30320

Vision test battery threshold and response time as predictors of air-to-air visual target acquisition in F-14 and adversary aircraft p 400 N86-30321

The effect of spectrally selective filters on visual search performance
[AD-A165835] p 404 N86-30329

The importance of specialized cognitive function in the

selection of military pilots

[AD-A165889] p 404 N86-30330

Novel architectures for image processing based on computer simulation and psychophysical studies of human visual cortex
[AD-A166222] p 404 N86-30333

VISUAL STIMULI

Division of attention as a function of the number of steps, visual shifts, and memory load
[NASA-TM-88775] p 404 N86-30328

VISUAL TASKS

Preferred declination of the line of sight p 406 A86-45014
Enhanced detection in the aperture of focal attention during simple discrimination tasks p 403 A86-45955
Entry visual standards and ocular examination techniques for future fighter aircrew p 400 N86-30317
Division of attention as a function of the number of steps, visual shifts, and memory load
[NASA-TM-88775] p 404 N86-30328

VOLCANOLOGY

Effects of lunar soil, Zagami meteorite, and ocean ridge basalt on the excretion of itoic acid, a siderophore, and coproporphyrin by *Bacillus subtilis* p 412 N86-31421

W

WATER HEATING

Development of thermoelectric water heating-cooling devices
[AD-A166949] p 409 N86-31221

WATER IMMERSION

Effect of head-out water immersion on response to exercise training p 396 A86-44194

WATER TREATMENT

Defining reclaimed water potability requirements p 410 N86-31422

WEIGHTLESSNESS

The role of gravity in producing digestive system changes p 391 A86-43677
The temporal response of bone to unloading
[NASA-TM-89228] p 397 N86-30303
Selection of an appropriate animal model for study of bone loss in weightlessness p 412 N86-31436

WEIGHTLESSNESS SIMULATION

Zero-G simulation verifies EVA servicing of space station modules
[AIAA PAPER 86-2312] p 407 A86-46942

WORK CAPACITY

Changes in pericardial microcirculation in dogs during adaptation to static muscle loads p 392 A86-45321
The effect of high temperature on the heat exchange and the nutritional status of pilots p 397 A86-45325

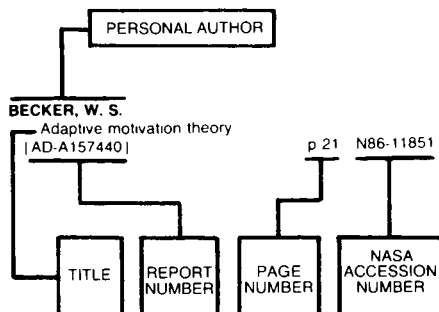
WORKLOADS (PSYCHOPHYSIOLOGY)

Review on secondary task technique for workload assessment Some consideration of secondary task paradigms and an assessment model p 403 A86-43539

An investigation of the use of steady-state evoked potentials for human performance and workload assessment and control
[AD-A166205] p 404 N86-30332

Basic human factors considerations
[DE86-008181] p 409 N86-31223

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document listed (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title. Under any one author's name the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

- ACEVEDO, O. L.**
Template-directed oligonucleotide ligation on hydroxylapatite p 393 A86-45960
- ADELMAN, B.**
The question of life on Mars p 410 A86-43927
- AL-MUFTI, S.**
Diatoms on earth, comets, Europa and in interstellar space p 410 A86-44354
The viability with respect to temperature, of micro-organisms incident on the earth's atmosphere p 410 A86-44358
- ALEXANDER, K. K.**
The technology impact of the Advanced Technology Crew Protection (ATCP) system on high performance aircraft p 406 A86-44779
- ALLEGRI, N.**
Selection and medical testing of Mirage 2000 pilots: Report of echocardiography p 399 N86-30314
- ALLEN, M. E.**
Naloxone enhances motion sickness - Endorphins implicated p 395 A86-44088
- ARVA, P.**
Diffuse pulmonary ossification and spontaneous pneumothorax in a pilot - A case report p 395 A86-44093
- ASKEW, G. K.**
The effect of spectrally selective filters on visual search performance [AD-A165835] p 404 N86-30329
- AUFREIT, R.**
The vertebral column: Selection and aptitude of combat aircraft pilots of the future p 400 N86-30322
- AZHAEV, A. N.**
The effect of high temperature on the heat exchange and the nutritional status of pilots p 397 A86-45325

B

- BACK, L. H.**
Fluid dynamic study in a femoral artery branch casting of man with upstream main lumen curvature for steady flow p 397 A86-45254

- BACK, M. R.**
Fluid dynamic study in a femoral artery branch casting of man with upstream main lumen curvature for steady flow p 397 A86-45254
- BAEV, A. V.**
The suppressive effect of carbon dioxide on the activation of cold receptors in the nasal cavity of cats p 392 A86-45319
- BALDIN, U. I.**
Assisted positive pressure breathing and modified anti-acceleration suit filling tested up to 9 G in a human centrifuge, Karolinska Institute [FOA-C-50038-H1] p 408 N86-30341
- BANDICK, N. R.**
Intrinsic alteration of the reactive properties of arteries during hypothermia [AD-A166523] p 402 N86-31213
- BANTA, G. R.**
Relationship of cardiopulmonary fitness to flight performance in tactical aviation p 401 N86-30326
- BARD, J. F.**
Evaluating space station applications of automation and robotics technologies from a human productivity point of view p 409 N86-31412
- BARNARD, R. W.**
Making the human-machine interface responsive to many classes of users [DE86-003453] p 409 N86-31222
- BARZILAY, J.**
Low back pain in pilots p 395 A86-44092
- BENBASSAT, J.**
The significance of recurrent childhood respiratory disorders in flight training applicants p 395 A86-44095
- BERGER, E. H.**
Methods of measuring the attenuation of hearing protection devices p 406 A86-45073
- BIKLE, D. D.**
The temporal response of bone to unloading [NASA-TM-89228] p 397 N86-30303
- BLACKMAN, H. S.**
Process of task analysis [DE86-008183] p 409 N86-31225
- BOER, L. C.**
Attention tasks and their relation to aging and flight experience [IZF-1986-4] p 405 N86-30337
- BONDI, K. R.**
Calcium and vitamin D metabolism in submariners: Carbon dioxide, sunlight and absorption considerations [AD-A166292] p 398 N86-30306
- BRENNAN, D. H.**
Entry visual standards and ocular examination techniques for future fighter aircrew p 400 N86-30317
- BRIGGS, R. P.**
Vision test battery threshold and response time as predictors of air-to-air visual target acquisition in F-14 and adversary aircraft p 400 N86-30321
- BRUTTIG, S. P.**
Thermoregulation after atropine and pralidoxime administration [AD-A165868] p 397 N86-30304
- BULBULIAN, R.**
Physical training and +Gz tolerance reevaluated p 396 A86-44096
- BURBECK, C. A.**
Spatiotemporal characteristics of visual localization [AD-A166097] p 404 N86-30331
- BURLATON, J. P.**
Continuous ECG monitoring of Mirage 2000 pilots (comparison with Mirage 3 and F1 pilots) p 399 N86-30315
- BURTON, R. R.**
Simulated aerial combat maneuvering tolerance and physical conditioning - Current status p 396 A86-44097
- BUTLER, K.**
Division of attention as a function of the number of steps, visual shifts, and memory load [NASA-TM-88775] p 404 N86-30328

C

- CADARETTE, B. S.**
Thermoregulation after atropine and pralidoxime administration [AD-A165868] p 397 N86-30304
- CAINE, Y.**
Low back pain in pilots p 395 A86-44092
The significance of recurrent childhood respiratory disorders in flight training applicants p 395 A86-44095
- CANNON, J. G.**
Metabolic changes following eccentric exercise in trained and untrained men [AD-A166521] p 402 N86-31211
- CASE, C. M.**
Advanced operator/system interface concepts for the Space Station [AIAA PAPER 86-2317] p 407 A86-46945
- CHAMBOST, G.**
G-induced loss of consciousness - Combat aircraft pilots head for trouble p 396 A86-44814
- CHANG, M. S.**
Bacterial inactivation by means of ionizing radiation [DE86-901038] p 412 N86-30348
- CHECHILE, R. A.**
Division of attention as a function of the number of steps, visual shifts, and memory load [NASA-TM-88775] p 404 N86-30328
- CHEN, L. H.**
Bacterial inactivation by means of ionizing radiation [DE86-901038] p 412 N86-30348
- CHISUM, G. T.**
The effect of spectrally selective filters on visual search performance [AD-A165835] p 404 N86-30329
- CHO, Y. I.**
Fluid dynamic study in a femoral artery branch casting of man with upstream main lumen curvature for steady flow p 397 A86-45254
- CLEMMER, T. P.**
Air ambulance regulations - A model p 405 A86-44094
- CLERE, J. H.**
The use of ECG changes caused by acceleration as tolerance prediction factors p 399 N86-30316
- CLERE, J. M.**
Physical training of Mirage 2000 pilots p 401 N86-30324
- CLIFFORD, P. S.**
Effect of head-out water immersion on response to exercise training p 396 A86-44194
- COLIN, J.**
Circadian variations of systolic time intervals p 394 A86-44087
- CORBE, C.**
Sensitivity to color contrasts and the selection of navigator personnel p 400 N86-30318
- CYMERMAN, A.**
An environmentally-controlled extended-use small animal hypobaric chamber [AD-A166729] p 398 N86-30307

D

- DAHLHAUSEN, M. J.**
Environmental control/life support system for Space Station p 407 A86-45692
- DAVYDOV, B. I.**
Radiofrequencies and microwaves - Radiation safety of the operator p 397 A86-46270
- DEHART, R. M.**
Human factors problems in the tactical air command p 396 A86-44778
Medical selection and physiological training of fighter pilots: A 1985 perspective and overview p 399 N86-30312
Cardiovascular standards for selection and retention of high performance pilots in the USAF: Perspectives for the next decade p 399 N86-30313

DELAHAYE, R. P.

The vertebral column: Selection and aptitude of combat aircraft pilots of the future p 400 N86-30322

DELATTRE, J. P.

Physical training of Mirage 2000 pilots p 401 N86-30324

DEVINE, J. A.

An environmentally-controlled extended-use small animal hypobaric chamber [AD-A166729] p 398 N86-30307

DIDIER, A.

Selection and medical testing of Mirage 2000 pilots: Report of echocardiography p 399 N86-30314

DINARELLO, C. A.

Metabolic changes following eccentric exercise in trained and untrained men [AD-A166521] p 402 N86-31211

DRAPER, J. V.

Human factors activities in teleoperator development at the Oak Ridge National Laboratory [DE86-005160] p 408 N86-30340

DURANTE, W.

The possible involvement of PGI₂ in the PEEP-induced changes in cardiac output and blood pressure p 395 A86-44091

DVORETSKAIA, T. P.

The contractile function and the energy metabolism of the myocardium under emotional stress and during adaptation of animals to short stress effects p 392 A86-45322

E**EAVES, D. M.**

Naloxone enhances motion sickness - Endorphins implicated p 395 A86-44088

EFIMOV, V. A.

The effect of high temperature on the heat exchange and the nutritional status of pilots p 397 A86-45325

EHRET, C. F.

Multiparameter data acquisition systems for studies of Circadian rhythms [DE86-004041] p 398 N86-30308

EHRLICH, S.

Visual accommodation and virtual image displays - Target detection and recognition p 406 A86-45015

EISLER, W. J., JR.

Multiparameter data acquisition systems for studies of Circadian rhythms [DE86-004041] p 398 N86-30308

EKHOLDT, P. F.

Diffuse pulmonary ossification and spontaneous pneumothorax in a pilot - A case report p 395 A86-44093

ENGELKEN, E. J.

Single sinusoids compared with a multiple-sinusoids technique for evaluating horizontal semicircular canal function p 395 A86-44089
Computer analysis of visual and vestibular oculomotor function in the medical selection of fighter aircrew members p 400 N86-30319

EVANS, W. J.

Metabolic changes following eccentric exercise in trained and untrained men [AD-A166521] p 402 N86-31211

F**FARRELL, S. M.**

An updated model for a Space Station Health Maintenance Facility [AIAA PAPER 86-2303] p 397 A86-46938

FELDMAN, M.

The significance of recurrent childhood respiratory disorders in flight training applicants p 395 A86-44095

FILLMORE, D. L.

Basic human factors considerations [DE86-008181] p 409 N86-31223
Human factors management [DE86-008184] p 409 N86-31226

FITTS, R. H.

Models of disuse - A comparison of hindlimb suspension and immobilization p 391 A86-44196

FLAGEAT, J.

The vertebral column: Selection and aptitude of combat aircraft pilots of the future p 400 N86-30322

FORECAST, D.

Low back pain in pilots p 395 A86-44092

FRANKSHTEIN, S. I.

The effects of cerebral hypoxia and hyperventilatory hypocapnia on the epileptiform activity in the cerebral cortex of cats p 392 A86-45318

FRAZIER, J. W.

The effect of breathing elevated CO₂ gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz [AD-A165974] p 401 N86-31210

FRONTERA, W. R.

Metabolic changes following eccentric exercise in trained and untrained men [AD-A166521] p 402 N86-31211

FROOM, P.

Low back pain in pilots p 395 A86-44092
The significance of recurrent childhood respiratory disorders in flight training applicants p 395 A86-44095

FU, Y. K.

Bacterial inactivation by means of ionizing radiation [DE86-901038] p 412 N86-30348

G**GAIDAR, B. V.**

Correlations between the levels of cerebral blood flow and cerebrovascular reactivity and the functional state of brain tissue p 392 A86-45320

GAUTHIER, G. M.

Inhibitory effects of combined agonist and antagonist muscle vibration on H-reflex in man p 395 A86-44090

GERTMAN, D. I.

Process of task analysis [DE86-008183] p 409 N86-31225

GIBBONS, H.

Air ambulance regulations - A model p 405 A86-44094

GLEBOVSKII, V. D.

The suppressive effect of carbon dioxide on the activation of cold receptors in the nasal cavity of cats p 392 A86-45319

GLOBUS, R. K.

The temporal response of bone to unloading [NASA-TM-89228] p 397 N86-30303

GONZALEZ, R. R.

Thermoregulation after atropine and pralidoxime administration [AD-A165868] p 397 N86-30304
Induced erythrocythemia and maximal aerobic power: An examination of modifying factors [AD-A166522] p 402 N86-31212

GOODYEAR, C. D.

The effect of breathing elevated CO₂ gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz [AD-A165974] p 401 N86-31210

GORDON, H. W.

The importance of specialized cognitive function in the selection of military pilots [AD-A165889] p 404 N86-30330

GRAY, G.

Canadian forces approach to aircrew medical selection p 399 N86-30311

GRIFFIN, B. N.

Zero-G simulation verifies EVA servicing of space station modules [AIAA PAPER 86-2312] p 407 A86-46942

GRISSETT, J. D.

Relationship of cardiopulmonary fitness to flight performance in tactical aviation p 401 N86-30326

GROH, K. R.

Multiparameter data acquisition systems for studies of Circadian rhythms [DE86-004041] p 398 N86-30308

GUTOWSKI, W.

Division of attention as a function of the number of steps, visual shifts, and memory load [NASA-TM-88775] p 404 N86-30328

H**HAMILTON, D.**

Naloxone enhances motion sickness - Endorphins implicated p 395 A86-44088

HAMILTON, P. V.

Visual capabilities related to fighter aircrew performance in the F-14 and adversary aircraft p 400 N86-30320
Vision test battery threshold and response time as predictors of air-to-air visual target acquisition in F-14 and adversary aircraft p 400 N86-30321

HAMMER, J. M.

Pilot interaction with automated airborne decision making systems [NASA-CR-176986] p 408 N86-31218

HANEY, L. N.

Process of task analysis [DE86-008183] p 409 N86-31225

HANNAN, P. J.

Advantages of the gas exchange approach to microbiological studies [AD-A166887] p 393 N86-31207

HARP, S. A.

Sensitivity to visual motion in statistically defined displays [AD-A167291] p 405 N86-31217

HARRISON, A. A.

Implications of privacy needs and interpersonal distancing mechanisms for space station design [NASA-CR-176938] p 408 N86-30338

HARVEY, W. T.

An updated model for a Space Station Health Maintenance Facility [AIAA PAPER 86-2303] p 397 A86-46938

HENNEMAN, T. A.

The technology impact of the Advanced Technology Crew Protection (ATCP) system on high performance aircraft p 406 A86-44779

HEPPNER, D. B.

Environmental control/life support system for Space Station p 407 A86-45692

HERNDON, J. N.

Human factors activities in teleoperator development at the Oak Ridge National Laboratory [DE86-005160] p 408 N86-30340

HERRON, D. M.

Hypobaric training of flight personnel without compromising quality of life p 401 N86-30327

HICKMAN, J. R., JR.

Cardiovascular standards for selection and retention of high performance pilots in the USAF: Perspectives for the next decade p 399 N86-30313

HILL, S. G.

Preferred declination of the line of sight p 406 A86-45014

HINGHOFFER-SZALKAY, H.

Continuous blood densitometry - Fluid shifts after graded hemorrhage in animals p 392 A86-45251

HOLICK, M.

Calcium and vitamin D metabolism in submariners: Carbon dioxide, sunlight and absorption considerations [AD-A166292] p 398 N86-30306

HOMER, L. D.

How well mixed is inert gas in tissues? p 391 A86-44197

HOOVER, M. J.

Diatoms on earth, comets, Europa and in interstellar space p 410 A86-44354

HOOVER, R. B.

Diatoms on earth, comets, Europa and in interstellar space p 410 A86-44354

HORIUCHI, S.

Detection of system failure by human operator. I - The case of monitor p 403 A86-43535

HORMAN, R. L.

Impact of the human on system safety analysis [DE86-008182] p 409 N86-31224

HOWARD, A. J.

An updated model for a Space Station Health Maintenance Facility [AIAA PAPER 86-2303] p 397 A86-46938

HOYLE, F.

Diatoms on earth, comets, Europa and in interstellar space p 410 A86-44354
The viability with respect to temperature, of micro-organisms incident on the earth's atmosphere p 410 A86-44358

HOYT, K.

Implications of privacy needs and interpersonal distancing mechanisms for space station design [NASA-CR-176938] p 408 N86-30338

HUMPHRIES, W. R.

Growth evolution of the Space Station ECLSS [AIAA PAPER 86-2313] p 407 A86-46943

I**ILLE, H.**

Selection and medical testing of Mirage 2000 pilots: Report of echocardiography p 399 N86-30314

ITO, T.

Effects of lunar soil, Zagami meteorite, and ocean ridge basalt on the excretion of itoic acid, a siderophore, and coproporphyrin by *Bacillus subtilis* p 412 N86-31421

J**JACOBSEN, A. R.**

The effects of color-coding in GEOSIT (geographical situational) displays. 2: Redundant versus non-redundant color-coding [AD-A166263] p 405 N86-30334

- JAMAR, P. G.**
Impact of automation on Space Station MMI design
[AIAA PAPER 86-2316] p 407 A86-46944
- JANIK, D. S.**
Defining reclaimed water potability requirements
p 410 N86-31422
- JOHANSON, D. C.**
Inflight loss of consciousness - A first look at the U.S. Navy experience
p 396 A86-44780
- JOHNSON, J. A.**
Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia
p 391 A86-44195
- JONES, D. S.**
Advantages of the gas exchange approach to microbiological studies
[AD-A166887] p 393 N86-31207
- JULESZ, B.**
Enhanced detection in the aperture of focal attention during simple discrimination tasks
p 403 A86-45955

K

- KALBFLEISCH, J. H.**
Effect of head-out water immersion on response to exercise training
p 396 A86-44194
- KATKOVA, L. S.**
The contractile function and the energy metabolism of the myocardium under emotional stress and during adaptation of animals to short stress effects
p 392 A86-45322
- KAUNE, W. T.**
Physical interaction of humans and animals with power-frequency electric and magnetic fields
[DE86-007734] p 402 N86-31215
- KEREN, G.**
Cognitive aspects of command and control
[IZF-1986-2] p 405 N86-30336
- KOLKA, M. A.**
Thermoregulation after atropine and pralidoxime administration
[AD-A165868] p 397 N86-30304
- KONAGAYA, M.**
A possible role for endogenous glucocorticoids in orchiectomy-induced atrophy of the rat levator ani muscle: Studies with RU38486, a potent and selective antiglucocorticoid
[NASA-CR-177029] p 411 N86-30343
- KROBUSEK, R. D.**
Aircrew aspects of United States future fighter aircraft
p 398 N86-30310
- KROEMER, K. H. E.**
Preferred declination of the line of sight
p 406 A86-45014
- KUROCHKIN, I. V.**
Experimental estimate of the parameters of a stochastic model of a human operator sensor system
p 407 A86-45117

L

- LEBEDEV, N. N.**
Digestive system rhythms and the body's biological clock
p 391 A86-43676
- LEBUI, D. A.**
Multiparameter data acquisition systems for studies of Circadian rhythms
[DE86-004041] p 398 N86-30308
- LEGUAY, G.**
Continuous ECG monitoring of Mirage 2000 pilots (comparison with Mirage 3 and F1 pilots)
p 399 N86-30315
- LEIGHTY, R.**
The importance of specialized cognitive function in the selection of military pilots
[AD-A165889] p 404 N86-30330
- LEMOT, J.**
Physical training of Mirage 2000 pilots
p 401 N86-30324
- LESSARD, C. S.**
Analysis of nystagmus response to a pseudorandom velocity input
p 402 N86-31426
- LEWIS, C. M.**
Pilot interaction with automated airborne decision making systems
[NASA-CR-176986] p 408 N86-31218
- VL1**
Representation for closed form significance testing in
p 408 N86-31219
- LIFANTEV, V. I.**
The contractile function and the energy metabolism of the myocardium under emotional stress and during adaptation of animals to short stress effects
p 392 A86-45322

- LIN, P. S. Y.**
Advanced operator/system interface concepts for the Space Station
[AIAA PAPER 86-2317] p 407 A86-46945
- LOZINSKII, P. A.**
The effect of high temperature on the heat exchange and the nutritional status of pilots
p 397 A86-45325

M

- MALTSEV, A. A.**
Experimental estimate of the parameters of a stochastic model of a human operator sensor system
p 407 A86-45117
- MALYSHEV, V. V.**
The contractile function and the energy metabolism of the myocardium under emotional stress and during adaptation of animals to short stress effects
p 392 A86-45322
- MARGALOT, S.**
Low back pain in pilots
p 395 A86-44092
- The significance of recurrent childhood respiratory disorders in flight training applicants**
p 395 A86-44095
- MAROTTE, H.**
Circadian variations of systolic time intervals
p 394 A86-44087
- MARTIN, B. J.**
Inhibitory effects of combined agonist and antagonist muscle vibration on H-reflex in man
p 395 A86-44090
- MATHIPRAKASAM, B.**
Development of thermoelectric water heating-cooling devices
[AD-A166949] p 409 N86-31221
- MATTHEWS, R. A.**
Inflight loss of consciousness - A first look at the U.S. Navy experience
p 396 A86-44780
- MAUREL, C.**
Selection and medical testing of Mirage 2000 pilots: Report of echocardiography
p 399 N86-30314
- MAX, S. R.**
A possible role for endogenous glucocorticoids in orchiectomy-induced atrophy of the rat levator ani muscle: Studies with RU38486, a potent and selective antiglucocorticoid
[NASA-CR-177029] p 411 N86-30343
- MCGRANAHAN, G. M., JR.**
Cardiovascular standards for selection and retention of high performance pilots in the USAF: Perspectives for the next decade
p 399 N86-30313
- MCKAY, C.**
Naloxone enhances motion sickness - Endorphins implicated
p 395 A86-44088
- MEEHAN, R. T.**
Flow cytometry analysis of hormone receptors on human peripheral blood mononuclear cells to identify stress-induced neuroendocrine effects
p 403 N86-31428
- MENU, J. P.**
Sensitivity to color contrasts and the selection of navigator personnel
p 400 N86-30318
- MEREDITH, C. N.**
Metabolic changes following eccentric exercise in trained and untrained men
[AD-A166521] p 402 N86-31211
- MESSINGER-RAPPORT, B. J.**
The inverse problem in electrocardiography - A model study of the effects of geometry and conductivity parameters on the reconstruction of epicardial potentials
p 394 A86-43750

- METGES, P. J.**
The vertebral column: Selection and aptitude of combat aircraft pilots of the future
p 400 N86-30322
- METZGER, J. M.**
Models of disuse - A comparison of hindlimb suspension and immobilization
p 391 A86-44196
- MIASNIK, M. N.**
The photobiological aspects of radiation damage in cells
p 392 A86-44295
- MILLER, C. W.**
Environmental control/life support system for Space Station
p 407 A86-45692
- MITCHELL, C. M.**
Pilot interaction with automated airborne decision making systems
[NASA-CR-176986] p 408 N86-31218
- A discrete control model of PLANT**
p 408 N86-31220
- MOISE, S. L., JR.**
An investigation of the use of steady-state evoked potentials for human performance and workload assessment and control
[AD-A166205] p 404 N86-30332
- MONACO, W. A.**
Visual capabilities related to fighter aircrew performance in the F-14 and adversary aircraft
p 400 N86-30320

- MOREY-HOLTON, E.**
The temporal response of bone to unloading
[NASA-TM-89228] p 397 N86-30303
- MOREY, W. A.**
Vision test battery threshold and response time as predictors of air-to-air visual target acquisition in F-14 and adversary aircraft
p 400 N86-30321
- MORRIS, A.**
Vision test battery threshold and response time as predictors of air-to-air visual target acquisition in F-14 and adversary aircraft
p 400 N86-30321
- MORRIS, N. M.**
Pilot interaction with automated airborne decision making systems
[NASA-CR-176986] p 408 N86-31218
- MORWAY, P. E.**
The effect of spectrally selective filters on visual search performance
[AD-A165835] p 404 N86-30329
- MURAYEV, A. V.**
Changes in pericardial microcirculation in dogs during adaptation to static muscle loads
p 392 A86-45321
- MUZA, S. R.**
Human vascular fluid responses to cold stress are not altered by cold acclimation
[AD-A165869] p 398 N86-30305
- Induced erythrocythemia and maximal aerobic power: An examination of modifying factors**
[AD-A166522] p 402 N86-31212

N

- NAGASAWA, Y.**
Review on secondary task technique for workload assessment Some consideration of secondary task paradigms and an assessment model
p 403 A86-43539
- NAKAMURA, A.**
Alteration of rat brain catecholamine levels under hypoxia
p 391 A86-43540
- NERI, D. F.**
The effects of color-coding in GEOSIT (geographical situational) displays. 2: Redundant versus non-redundant color-coding
[AD-A166263] p 405 N86-30334
- NERTNEY, R. J.**
Basic human factors considerations
[DE86-008181] p 409 N86-31223
- Impact of the human on system safety analysis**
[DE86-008182] p 409 N86-31224
- Human factors management**
[DE86-008184] p 409 N86-31226
- NIWEOHNER, D.**
Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia
p 391 A86-44195
- NORMAN, J.**
Visual accommodation and virtual image displays - Target detection and recognition
p 406 A86-45015

O

- OLSON, J. E.**
Single sinusoids compared with a multiple-sinusoids technique for evaluating horizontal semicircular canal function
p 395 A86-44089
- OPPEDAL, B. R.**
Diffuse pulmonary ossification and spontaneous pneumothorax in a pilot - A case report
p 395 A86-44093
- ORGEL, L. E.**
Template-directed oligonucleotide ligation on hydroxylapatite
p 393 A86-45960

P

- PALMER, E. A.**
Division of attention as a function of the number of steps, visual shifts, and memory load
[NASA-TM-88775] p 404 N86-30328
- PALMER, J. F.**
Inflight loss of consciousness - A first look at the U.S. Navy experience
p 396 A86-44780
- PANDOLF, K. B.**
Human vascular fluid responses to cold stress are not altered by cold acclimation
[AD-A165869] p 398 N86-30305
- Induced erythrocythemia and maximal aerobic power: An examination of modifying factors**
[AD-A166522] p 402 N86-31212
- PAULL, R. M.**
Cardiovascular standards for selection and retention of high performance pilots in the USAF: Perspectives for the next decade
p 399 N86-30313

PEARLMAN, F. C.

An updated model for a Space Station Health Maintenance Facility
[AIAA PAPER 86-2303] p 397 A86-46938

PHEENY, H. T.

Inflight loss of consciousness - A first look at the U.S. Navy experience p 396 A86-44780

PIPER, R.

Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia p 391 A86-44195

PIRQUIN, G.

Treadmill spiroergometry in the selection and screening of high-performance combat aircraft pilots in the Beligan Air Force p 401 N86-30325

POIRIER, J. L.

The use of ECG changes caused by acceleration as tolerance prediction factors p 399 N86-30316

POITRAST, B. J.

Assessing possible damage due to radio frequency radiation [AD-A166913] p 402 N86-31214

POTKIN, V. E.

The effect of high temperature on the heat exchange and the nutritional status of pilots p 397 A86-45325

POYOT, G.

Continuous ECG monitoring of Mirage 2000 pilots (comparison with Mirage 3 and F1 pilots) p 399 N86-30315

Physical training of Mirage 2000 pilots p 401 N86-30324

PRICHARD, H. M.

Cytogenetic analyses of peripheral lymphocytes subjected to simulated solar flare radiation p 412 N86-31431

R

RAAIJMAKERS, J. G. W.

Cognitive aspects of command and control [IZF-1986-2] p 405 N86-30336

REISLER, H.

Laser kinetic spectroscopy of unimolecular and bimolecular processes in the gas phase [AD-A166998] p 394 N86-31209

REPPERGER, D. W.

The effect of breathing elevated CO₂ gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz [AD-A165974] p 401 N86-31210

RILEY, D. A.

Models of disuse - A comparison of hindlimb suspension and immobilization p 391 A86-44196

RIVERS, R.

Intelligent crew workstations p 406 A86-44532

ROBERTS, D. E.

Intrinsic alteration of the reactive properties of arteries during hypothermia [AD-A166523] p 402 N86-31213

ROGERS, W. H.

The effects of color-coding in GEOSIT (geographical situational) displays. 2: Redundant versus non-redundant color-coding [AD-A166263] p 405 N86-30334

ROLL, J. P.

Inhibitory effects of combined agonist and antagonist muscle vibration on H-reflex in man p 395 A86-44090

ROUSE, W. B.

Pilot interaction with automated airborne decision making systems [NASA-CR-176986] p 408 N86-31218

ROUVRAY, D. H.

The prediction of biological activity using molecular connectivity indices [AD-A166986] p 394 N86-31208

RUDY, Y.

The inverse problem in electrocardiography - A model study of the effects of geometry and conductivity parameters on the reconstruction of epicardial potentials p 394 A86-43750

S

SACK, D. M.

Calcium and vitamin D metabolism in submariners: Carbon dioxide, sunlight and absorption considerations [AD-A166292] p 398 N86-30306

SAGI, D.

Enhanced detection in the aperture of focal attention during simple discrimination tasks p 403 A86-45955

SAKURAI, I.

Alteration of rat brain catecholamine levels under hypoxia p 391 A86-43540

SANTUCCI, G.

Sensitivity to color contrasts and the selection of navigator personnel p 400 N86-30318

SAWKA, M. N.

Human vascular fluid responses to cold stress are not altered by cold acclimation [AD-A165869] p 398 N86-30305

Induced erythrocythemia and maximal aerobic power: An examination of modifying factors [AD-A166522] p 402 N86-31212

SCHUBERT, F. H.

Environmental control/life support system for Space Station p 407 A86-45692

SCHWARTZ, E. L.

Novel architectures for image processing based on computer simulation and psychophysical studies of human visual cortex [AD-A166222] p 404 N86-30333

SEIGNEURIC, A.

Continuous ECG monitoring of Mirage 2000 pilots (comparison with Mirage 3 and F1 pilots) p 399 N86-30315

SEKULER, R. W.

Sensitivity to visual motion in statistically defined displays [AD-A167291] p 405 N86-31217

SEMERIN, V. N.

Correlations between the levels of cerebral blood flow and cerebrovascular reactivity and the functional state of brain tissue p 392 A86-45320

SERGEEVA, L. N.

The effects of cerebral hypoxia and hyperventilatory hypocapnia on the epileptiform activity in the cerebral cortex of cats p 392 A86-45318

SHCHUKINA, M. IA.

The content of lactic acid in the blood and erythropoiesis during hypoxia p 393 A86-45324

SHEEHY, J. B.

The effect of spectrally selective filters on visual search performance [AD-A165835] p 404 N86-30329

SHELDAL, L. M.

Effect of head-out water immersion on response to exercise training p 396 A86-44194

SHESTAKOV, V. A.

Changes in pericardial microcirculation in dogs during adaptation to static muscle loads p 392 A86-45321

SHRIVER, T. G.

The effect of breathing elevated CO₂ gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz [AD-A165974] p 401 N86-31210

SIMONOV, P. V.

Theoretical principles underlying the evaluation, control, and correction of the impact of emotions on cosmonaut activity p 403 A86-44601

SINHA, A. A.

Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia p 391 A86-44195

SKVORTSOV, V. G.

The photobiological aspects of radiation damage in cells p 392 A86-44295

SMIRNOV, K. V.

The role of gravity in producing digestive system changes p 391 A86-43677

SMITS, G.

Effect of head-out water immersion on response to exercise training p 396 A86-44194

SMOLIN, L. N.

The effects of cerebral hypoxia and hyperventilatory hypocapnia on the epileptiform activity in the cerebral cortex of cats p 392 A86-45318

SOKOLOV, V. A.

The photobiological aspects of radiation damage in cells p 392 A86-44295

SOMMER, R.

Implications of privacy needs and interpersonal distancing mechanisms for space station design [NASA-CR-176938] p 408 N86-30338

SOSNAY, R. G.

Growth evolution of the Space Station ECLSS [AIAA PAPER 86-2313] p 407 A86-46943

STANLEY, D.

Intelligent crew workstations p 406 A86-44532

STEPHENSON, L. A.

Thermoregulation after atropine and pralidoxime administration [AD-A165868] p 397 N86-30304

STEVENS, K. W.

Single sinusoids compared with a multiple-sinusoids technique for evaluating horizontal semicircular canal function p 395 A86-44089

STEVENS, K., W.

Computer analysis of visual and vestibular oculomotor function in the medical selection of fighter aircrew members p 400 N86-30319

STRUTHERS, N.

Implications of privacy needs and interpersonal distancing mechanisms for space station design [NASA-CR-176938] p 408 N86-30338

SUNAHARA, F. A.

The possible involvement of PGI₂ in the PEEP-induced changes in cardiac output and blood pressure p 395 A86-44091

SYLVESTRE, M.

Continuous ECG monitoring of Mirage 2000 pilots (comparison with Mirage 3 and F1 pilots) p 399 N86-30315

T

THOMAS, F.

Air ambulance regulations - A model p 405 A86-44094

THOMPSON, S. A.

The technology impact of the Advanced Technology Crew Protection (ATCP) system on high performance aircraft p 406 A86-44779

THORMER, K.

Environmental control and life support systems p 406 A86-44534

TIMBAL, J.

Circadian variations of systolic time intervals p 394 A86-44087

TOPOROVA, S. G.

The effect of hypoxia on the dynamics of the peripheral lymph flow p 393 A86-45323

TRIPP, L. D.

The effect of breathing elevated CO₂ gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz [AD-A165974] p 401 N86-31210

TRISTANI, F. E.

Effect of head-out water immersion on response to exercise training p 396 A86-44194

TURK, P.

G-induced loss of consciousness - Combat aircraft pilots head for trouble p 396 A86-44814

U

UNSWORTH, B. R.

Models of disuse - A comparison of hindlimb suspension and immobilization p 391 A86-44196

V

VAINSHTEIN, G. B.

Correlations between the levels of cerebral blood flow and cerebrovascular reactivity and the functional state of brain tissue p 392 A86-45320

VANDALEN, A.

Systematic radiographic examination of the spine for selection of F-16 pilots: A preliminary report p 401 N86-30323

VANDENBIGGELAAR, H. H. M.

Systematic radiographic examination of the spine for selection of F-16 pilots: A preliminary report p 401 N86-30323

VANDENBOSCH, P.

Treadmill spiroergometry in the selection and screening of high-performance combat aircraft pilots in the Beligan Air Force p 401 N86-30325

VASTESAEGER, J.

Treadmill spiroergometry in the selection and screening of high-performance combat aircraft pilots in the Beligan Air Force p 401 N86-30325

VIELLEFOND, H.

The vertebral column: Selection and aptitude of combat aircraft pilots of the future p 400 N86-30322

VIELLEFORD, H.

The use of ECG changes caused by acceleration as tolerance prediction factors p 399 N86-30316

W

WANGENSTEEN, D.

Solute conductance of blood-gas barrier in hamsters exposed to hyperoxia p 391 A86-44195

WEATHERSBY, P. K.

How well mixed is inert gas in tissues? p 391 A86-44197

WICKRAMASINGHE, N. C.

Diatoms on earth, comets, Europa and in interstellar space p 410 A86-44354

The viability with respect to temperature, of micro-organisms incident on the earth's atmosphere p 410 A86-44358

WILLIAMS, D. W.

Sensitivity to visual motion in statistically defined displays
[AD-A167291] p 405 N86-31217

WITTIG, C.

Laser kinetic spectroscopy of unimolecular and bimolecular processes in the gas phase
[AD-A166998] p 394 N86-31209

WOLFE, J. W.

Single sinusoids compared with a multiple-sinusoids technique for evaluating horizontal semicircular canal function p 395 A86-44089

Computer analysis of visual and vestibular oculomotor function in the medical selection of fighter aircrew members p 400 N86-30319

WOLGEMUTH, D. J.

Effects of simulated weightlessness on meiosis. Fertilization, and early development in mice
[NASA-CR-177106] p 410 N86-30342

WOLINSKY, I.

Selection of an appropriate animal model for study of bone loss in weightlessness p 412 N86-31436

WOODY, C. D.

Neurophysiological research supporting the investigation of adaptive network architectures
[AD-A166074] p 405 N86-31216

WORDEN, R.

Intelligent crew workstations p 406 A86-44532

Y**YAMAGUCHI, T.**

Review on secondary task technique for workload assessment. Some consideration of secondary task paradigms and an assessment model p 403 A86-43539

YOON, W. C.

Pilot interaction with automated airborne decision making systems
[NASA-CR-176986] p 408 N86-31218

YOUNG, A. J.

Human vascular fluid responses to cold stress are not altered by cold acclimation
[AD-A165869] p 398 N86-30305

Induced erythrocythemia and maximal aerobic power: An examination of modifying factors
[AD-A166522] p 402 N86-31212

YOUNG, R. S.

Space Station - Life sciences
[AIAA PAPER 86-2346] p 393 A86-46960

YUHARA, N.

Detection of system failure by human operator. I - The case of monitor p 403 A86-43535

Z**ZAITSSEV, L. G.**

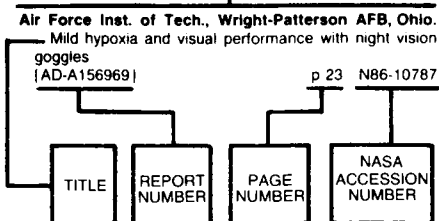
Changes in pericardial microcirculation in dogs during adaptation to static muscle loads p 392 A86-45321

ZELON, J. L.

Advanced space suit development for future on-orbit operations
[AIAA PAPER 86-2310] p 407 A86-46941

Typical Corporate Source
Index Listing

CORPORATE SOURCE



Listings in this index are arranged alphabetically by corporate source. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

A

Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

Medical Selection and Physiological Training of Future Fighter Aircrew
[AGARD-CP-396] p 398 N86-30309

Air Force Occupational and Environmental Health Lab., Brooks AFB, Tex.

Assessing possible damage due to radio frequency radiation
[AD-A166913] p 402 N86-31214

Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio.

Aircrew aspects of United States future fighter aircraft
p 398 N86-30310

Argonne National Lab., Ill.

Multiparameter data acquisition systems for studies of Circadian rhythms
[DE86-004041] p 398 N86-30308

Army Research Inst. of Environmental Medicine, Natick, Mass.

Thermoregulation after atropine and pralidoxime administration
[AD-A165868] p 397 N86-30304

Human vascular fluid responses to cold stress are not altered by cold acclimation
[AD-A165869] p 398 N86-30305

An environmentally-controlled extended-use small animal hypobaric chamber
[AD-A166729] p 398 N86-30307

Metabolic changes following eccentric exercise in trained and untrained men
[AD-A166521] p 402 N86-31211

Induced erythrocythemia and maximal aerobic power: An examination of modifying factors
[AD-A166522] p 402 N86-31212

Intrinsic alteration of the reactive properties of arteries during hypothermia
[AD-A166523] p 402 N86-31213

B

Belgian Air Force, Brussels.

Treadmill spirometry in the selection and screening of high-performance combat aircraft pilots in the Belgian Air Force
p 401 N86-30325

Boeing Aerospace Co., Huntsville, Ala.

Advanced operator/system interface concepts for the Space Station
[AIAA PAPER 86-2317] p 407 A86-46945

C

California Univ., Davis.

Implications of privacy needs and interpersonal distancing mechanisms for space station design
[NASA-CR-176938] p 408 N86-30338

California Univ., Los Angeles.

Neurophysiological research supporting the investigation of adaptive network architectures
[AD-A166074] p 405 N86-31216

CEAM, Mont-de-Marsan (France).

Physical training of Mirage 2000 pilots
p 401 N86-30324

Centre d'Essais en Vol, Bretigny-sur-Orge (France).

The use of ECG changes caused by acceleration as tolerance prediction factors
p 399 N86-30316

Centre d'Etudes et de Recherches de Medecine Aerospatiale, Paris (France).

Sensitivity to color contrasts and the selection of navigator personnel
p 400 N86-30318

Centre Principal d'Expertises Medicales du Personnel Navigant de l'Aeronautique, Paris (France).

Selection and medical testing of Mirage 2000 pilots: Report of echocardiography
p 399 N86-30314

Clarke Ambrose, Inc., Knoxville, Tenn.

Human factors activities in teleoperator development at the Oak Ridge National Laboratory
[DE86-005160] p 408 N86-30340

Columbia Univ., New York.

Effects of simulated weightlessness on meiosis. Fertilization, and early development in mice
[NASA-CR-177106] p 410 N86-30342

D

Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).

Canadian forces approach to aircrew medical selection
p 399 N86-30311

E

East Carolina Univ., Greenville, N.C.

Effects of lunar soil, Zagami meteorite, and ocean ridge basalt on the excretion of itoic acid, a siderophore, and coproporphyrin by *Bacillus subtilis*
p 412 N86-31421

Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.

Basic human factors considerations
[DE86-008181] p 409 N86-31223

Impact of the human on system safety analysis
[DE86-008182] p 409 N86-31224

Process of task analysis
[DE86-008183] p 409 N86-31225

Human factors management
[DE86-008184] p 409 N86-31226

F

Foersvarets Forskingsansalt, Stockholm (Sweden).

Assisted positive pressure breathing and modified anti-acceleration suit filling tested up to 9 G in a human centrifuge, Karolinska Institute
[FOA-C-50038-H1] p 408 N86-30341

G

Georgia Inst. of Tech., Atlanta.

Pilot interaction with automated airborne decision making systems
[NASA-CR-176986] p 408 N86-31218

Representation for closed form significance testing in VL1
p 408 N86-31219

A discrete control model of PLANT
p 408 N86-31220

Georgia Univ., Athens.

The prediction of biological activity using molecular connectivity indices
[AD-A166986] p 394 N86-31208

Graz Univ. (Austria).

Continuous blood densitometry - Fluid shifts after graded hemorrhage in animals
p 392 A86-45251

H

Hopital d'Instruction des Armees, Paris (France).

The vertebral column: Selection and aptitude of combat aircraft pilots of the future
p 400 N86-30322

Hopital d'Instruction des Armees, Versailles (France).

Continuous ECG monitoring of Mirage 2000 pilots (comparison with Mirage 3 and F1 pilots)
p 399 N86-30315

Houston Univ., Tex.

Selection of an appropriate animal model for study of bone loss in weightlessness
p 412 N86-31436

I

Institute for Perception Research, Eindhoven (Netherlands).

Activities report in perception research
[IPO-19-1984] p 405 N86-30335

Institute for Perception RVO-TNO, Soesterberg (Netherlands).

Cognitive aspects of command and control
[IZF-1986-2] p 405 N86-30336

Attention tasks and their relation to aging and flight experience
[IZF-1986-4] p 405 N86-30337

Institute of Nuclear Energy Research, Lung-Tan (Taiwan).

Bacterial inactivation by means of ionizing radiation
[DE86-901038] p 412 N86-30348

J

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

Fluid dynamic study in a femoral artery branch casting of man with upstream main lumen curvature for steady flow
p 397 A86-45254

L

Life Systems, Inc., Cleveland, Ohio.

Environmental control/life support system for Space Station
p 407 A86-45692

M

Marquette Univ., Milwaukee, Wis.

Models of disuse - A comparison of hindlimb suspension and immobilization
p 391 A86-44196

Martin Marietta Aerospace, Denver, Colo.

Growth evolution of the Space Station ECLSS
[AIAA PAPER 86-2313] p 407 A86-46943

Maryland Univ., Baltimore.

A possible role for endogenous glucocorticoids in orchectomy-induced atrophy of the rat levator ani muscle: Studies with RU38486, a potent and selective antiglucocorticoid
[NASA-CR-177029] p 411 N86-30343

Midwest Research Inst., Kansas City, Mo.

Midwest Research Inst., Kansas City, Mo.

Development of thermoelectric water heating-cooling devices

[AD-A166949] p 409 N86-31221

Militair Hospitaal Dr. A. Mathijssen, Utrecht (Netherlands).

Systematic radiographic examination of the spine for selection of F-16 pilots: A preliminary report

p 401 N86-30323

N

National Aeronautics and Space Administration, Washington, D.C.

Life Sciences Space Station planning document: A reference payload for the Life Sciences Research Facility

[NASA-TM-89188] p 393 N86-30302

National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

Continuous blood densitometry - Fluid shifts after graded hemorrhage in animals

p 392 A86-45251

The temporal response of bone to unloading

[NASA-TM-89228] p 397 N86-30303

Division of attention as a function of the number of steps, visual shifts, and memory load

[NASA-TM-88775] p 404 N86-30328

National Aeronautics and Space Administration.

Lyndon B. Johnson Space Center, Houston, Tex.

Evaluating space station applications of automation and robotics technologies from a human productivity point of view

p 409 N86-31412

National Aeronautics and Space Administration.

Marshall Space Flight Center, Huntsville, Ala.

Diatoms on earth, comets, Europa and in interstellar space

p 410 A86-44354

Growth evolution of the Space Station ECLSS

[AIAA PAPER 86-2313] p 407 A86-46943

Naval Aerospace Medical Inst., Pensacola, Fla.

Hypobaric training of flight personnel without compromising quality of life

p 401 N86-30327

Naval Aerospace Medical Research Lab., Pensacola, Fla.

Visual capabilities related to fighter aircrew performance in the F-14 and adversary aircraft

p 400 N86-30320

Vision test battery threshold and response time as predictors of air-to-air visual target acquisition in F-14 and adversary aircraft

p 400 N86-30321

Relationship of cardiopulmonary fitness to flight performance in tactical aviation

p 401 N86-30326

Naval Air Development Center, Warminster, Pa.

The effect of spectrally selective filters on visual search performance

[AD-A165835] p 404 N86-30329

Naval Research Lab., Washington, D.C.

Advantages of the gas exchange approach to microbiological studies

[AD-A166887] p 393 N86-31207

Naval Submarine Medical Research Lab., Groton, Conn.

Calcium and vitamin D metabolism in submariners: Carbon dioxide, sunlight and absorption considerations

[AD-A166292] p 398 N86-30306

The effects of color-coding in GEOSIT (geographical situational) displays. 2: Redundant versus non-redundant color-coding

[AD-A166263] p 405 N86-30334

New York Univ. Medical Center.

Novel architectures for image processing based on computer simulation and psychophysical studies of human visual cortex

[AD-A166222] p 404 N86-30333

Northwestern Univ., Evanston, Ill.

Sensitivity to visual motion in statistically defined displays

[AD-A167291] p 405 N86-31217

Nova Technical, Inc., Tarzana, Calif.

An investigation of the use of steady-state evoked potentials for human performance and workload assessment and control

[AD-A166205] p 404 N86-30332

O

Oak Ridge National Lab., Tenn.

Human factors activities in teleoperator development at the Oak Ridge National Laboratory

[DE86-005160] p 408 N86-30340

C-2

P

Pacific Northwest Labs., Richland, Wash.

Biological studies of swine exposed to 60-Hz electric fields. Volume 5: Hematology and serum chemistry

[DE86-005362] p 411 N86-30344

Biological studies of swine exposed to 60-Hz electric fields. Volume 6: Immunology

[DE86-005363] p 411 N86-30345

Physical interaction of humans and animals with power-frequency electric and magnetic fields

[DE86-007734] p 402 N86-31215

Pittsburgh Univ., Pa.

The importance of specialized cognitive function in the selection of military pilots

[AD-A165889] p 404 N86-30330

R

Royal Air Force Inst. of Aviation Medicine,

Farnborough (England).

Entry visual standards and ocular examination techniques for future fighter aircrew

p 400 N86-30317

S

Salk Institute for Biological Studies, San Diego, Calif.

Template-directed oligonucleotide ligation on hydroxylapatite

p 393 A86-45960

Sandia National Labs., Albuquerque, N. Mex.

Making the human-machine interface responsive to many classes of users

[DE86-003453] p 409 N86-31222

School of Aerospace Medicine, Brooks AFB, Tex.

Cardiovascular standards for selection and retention of high performance pilots in the USAF: Perspectives for the next decade

p 399 N86-30313

Computer analysis of visual and vestibular oculomotor function in the medical selection of fighter aircrew members

p 400 N86-30319

Southwest Research Inst., San Antonio, Tex.

Effects of 60 Hz electric field on operant and social stress behaviors of nonhuman primates

[DE85-016121] p 411 N86-30346

Effects of 60 Hz electric fields on operant and social stress behaviors of nonhuman primates

[DE86-005807] p 411 N86-30347

SRI International Corp., Menlo Park, Calif.

Spatiotemporal characteristics of visual localization

[AD-A166097] p 404 N86-30331

Specifications Physiological Monitoring System

[NASA-CR-171926] p 408 N86-30339

Systems Research Labs., Inc., Dayton, Ohio.

The effect of breathing elevated CO₂ gas mixtures on tracking performance, blood pressure, and subjective tolerance at 1Gz

[AD-A165974] p 401 N86-31210

T

Tactical Air Command, Langley AFB, Va.

Medical selection and physiological training of fighter pilots: A 1985 perspective and overview

p 399 N86-30312

Texas A&M Univ., College Station.

Analysis of nystagmus response to a pseudorandom velocity input

p 402 N86-31426

Texas Univ., Galveston.

Flow cytometry analysis of hormone receptors on human peripheral blood mononuclear cells to identify stress-induced neuroendocrine effects

p 403 N86-31428

Texas Univ., Houston.

Cytogenetic analyses of peripheral lymphocytes subjected to simulated solar flare radiation

p 412 N86-31431

U

University Coll., Cardiff (Wales).

Diatoms on earth, comets, Europa and in interstellar space

p 410 A86-44354

University of Southern California, Los Angeles.

Laser kinetic spectroscopy of unimolecular and bimolecular processes in the gas phase

[AD-A166998] p 394 N86-31209

Utah Univ., Salt Lake City.

Defining reclaimed water potability requirements

p 410 N86-31422

CORPORATE SOURCE

V

Veterans Administration Hospital, San Francisco, Calif.

The temporal response of bone to unloading

[NASA-TM-89228] p 397 N86-30303

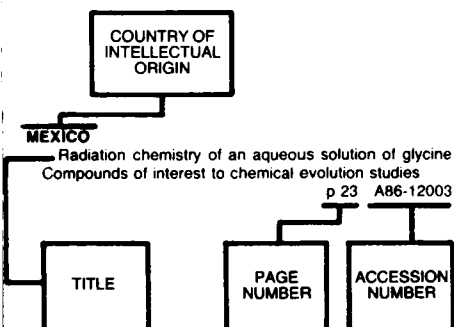
W

Wisconsin Univ., Milwaukee.

Models of disuse - A comparison of hindlimb suspension and immobilization

p 391 A86-44196

Typical Foreign Technology Index Listing



Listings in this index are arranged alphabetically by country of intellectual origin. The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the citation in the abstract section.

B

BELGIUM

Treadmill spiroergometry in the selection and screening of high-performance combat aircraft pilots in the Belgian Air Force p 401 N86-30325

C

CANADA

Naloxone enhances motion sickness - Endorphins implicated p 395 A86-44088
The possible involvement of PGI₂ in the PEEP-induced changes in cardiac output and blood pressure p 395 A86-44091
Canadian forces approach to aircrew medical selection p 399 N86-30311

F

FRANCE

Circadian variations of systolic time intervals p 394 A86-44087
Inhibitory effects of combined agonist and antagonist muscle vibration on H-reflex in man p 395 A86-44090
Medical Selection and Physiological Training of Future Fighter Aircrew [AGARD-CP-396] p 398 N86-30309
Selection and medical testing of Mirage 2000 pilots: Report of echocardiography p 399 N86-30314
Continuous ECG monitoring of Mirage 2000 pilots (comparison with Mirage 3 and F1 pilots) p 399 N86-30315
The use of ECG changes caused by acceleration as tolerance prediction factors p 399 N86-30316
Sensitivity to color contrasts and the selection of navigator personnel p 400 N86-30318
The vertebral column: Selection and aptitude of combat aircraft pilots of the future p 400 N86-30322

Physical training of Mirage 2000 pilots p 401 N86-30324

G

GERMANY, FEDERAL REPUBLIC OF

Environmental control and life support systems p 406 A86-44534

I

ISRAEL

Low back pain in pilots p 395 A86-44092
The significance of recurrent childhood respiratory disorders in flight training applicants p 395 A86-44095
Visual accommodation and virtual image displays - Target detection and recognition p 406 A86-45015
Enhanced detection in the aperture of focal attention during simple discrimination tasks p 403 A86-45955

J

JAPAN

Detection of system failure by human operator. I - The case of monitor p 403 A86-43535
Review on secondary task technique for workload assessment Some consideration of secondary task paradigms and an assessment model p 403 A86-43539
Alteration of rat brain catecholamine levels under hypoxia p 391 A86-43540

N

NETHERLANDS

Systematic radiographic examination of the spine for selection of F-16 pilots: A preliminary report p 401 N86-30323
Activities report in perception research [IPO-19-1984] p 405 N86-30335
Cognitive aspects of command and control [IZF-1986-2] p 405 N86-30336
Attention tasks and their relation to aging and flight experience [IZF-1986-4] p 405 N86-30337
Diffuse pulmonary ossification and spontaneous pneumothorax in a pilot - A case report p 395 A86-44093

S

SWEDEN

Assisted positive pressure breathing and modified anti-acceleration suit filling tested up to 9 G in a human centrifuge, Karolinska Institute [FOA-C-50038-H1] p 408 N86-30341

SWITZERLAND

G-induced loss of consciousness - Combat aircraft pilots head for trouble p 396 A86-44814

T

TAIWAN

Bacterial inactivation by means of ionizing radiation [DE86-901038] p 412 N86-30348

U

U.S.S.R.

Digestive system rhythms and the body's biological clock p 391 A86-43676
The role of gravity in producing digestive system changes p 391 A86-43677
The photobiological aspects of radiation damage in cells p 392 A86-44295

Theoretical principles underlying the evaluation, control, and correction of the impact of emotions on cosmonaut activity p 403 A86-44601
Experimental estimate of the parameters of a stochastic model of a human operator sensor system p 407 A86-45117

The effects of cerebral hypoxia and hyperventilatory hypocapnia on the epileptiform activity in the cerebral cortex of cats p 392 A86-45318
The suppressive effect of carbon dioxide on the activation of cold receptors in the nasal cavity of cats p 392 A86-45319

Correlations between the levels of cerebral blood flow and cerebrovascular reactivity and the functional state of brain tissue p 392 A86-45320
Changes in pericardial microcirculation in dogs during adaptation to static muscle loads p 392 A86-45321
The contractile function and the energy metabolism of the myocardium under emotional stress and during adaptation of animals to short stress effects p 392 A86-45322

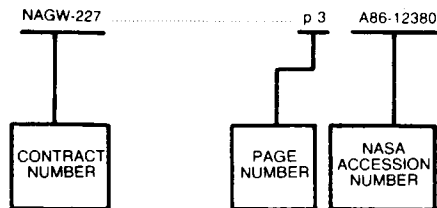
The effect of hypoxia on the dynamics of the peripheral lymph flow p 393 A86-45323
The content of lactic acid in the blood and erythropoiesis during hypoxia p 393 A86-45324
The effect of high temperature on the heat exchange and the nutritional status of pilots p 397 A86-45325
Radiofrequencies and microwaves - Radiation safety of the operator p 397 A86-46270

UNITED KINGDOM

The question of life on Mars p 410 A86-43927
The viability with respect to temperature, of micro-organisms incident on the earth's atmosphere p 410 A86-44358
Intelligent crew workstations p 406 A86-44532
Entry visual standards and ocular examination techniques for future fighter aircrew p 400 N86-30317

CONTRACT NUMBER INDEX

Typical Contract Number Index Listing



Listings in this index are arranged alpha-numerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the AIAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in the abstract section. Preceding the accession number is the page number on which the citation may be found.

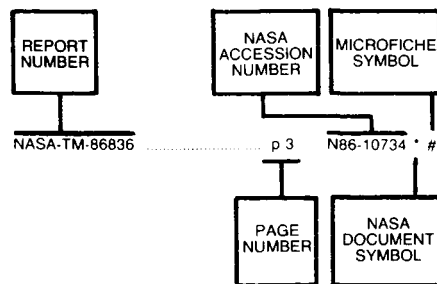
AF-AFOSR-0022-83	p 394	N86-31209
A83/KLU/078	p 405	N86-30337
DA PROJ. 1L1-62724-AH-99	p 409	N86-31221
DA PROJ. 2Q1-61102-B-74-F	p 405	N86-31217
DAAK60-85-C-0011	p 409	N86-31221
DE-AC02-80RA-50219	p 411	N86-30346
	p 411	N86-30347
DE-AC04-76DP-00789	p 409	N86-31222
DE-AC05-84OR-21400	p 408	N86-30340
DE-AC06-76RL-01830	p 411	N86-30344
	p 411	N86-30345
	p 402	N86-31215
DE-AC07-76ID-01570	p 409	N86-31223
	p 409	N86-31224
	p 409	N86-31225
	p 409	N86-31226
FFWF PROJECT 3470	p 392	A86-45251
F33615-81-C-0500	p 401	N86-31210
F33615-84-C-3407	p 406	A86-44779
F49620-82-K-0024	p 404	N86-30331
F49620-83-C-0077	p 405	N86-31216
F49620-83-C-0102	p 404	N86-30332
F49620-83-C-0108	p 404	N86-30333
MDA903-80-C-0154	p 405	N86-31217
NAGW-236	p 397	N86-30303
NAG2-100	p 411	N86-30343
NAG2-123	p 408	N86-31218
NAG2-212	p 391	A86-44196
NAG2-324	p 410	N86-30342
NAG2-357	p 408	N86-30338
NAS8-36526	p 407	A86-46945
NAS9-16811	p 408	N86-30339
NCA2-OR785-801	p 404	N86-30328
NCC2-266	p 391	A86-44196
NGR-05-067-001	p 393	A86-45960
NIH-GM-07250	p 394	A86-43750
NIH-HL-17931	p 394	A86-43750
NIH-HL-23619-05	p 397	A86-45254
NIH-HL-33343	p 394	A86-43750
N00014-83-K-0208	p 404	N86-30330
N00014-84-K-0365	p 394	N86-31208
USVA-7876-01P	p 396	A86-44194
W-31-109-ENG-38	p 398	N86-30308

REPORT NUMBER INDEX

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 291)

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Typical Report Number Index Listing



Listings in this index are arranged alphabetically by report number. The page number indicates the page on which the citation is located. The accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

AAMRL-TR-86-006 p 401 N86-31210 #

AD-A165835 p 404 N86-30329 #

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AD-A165869 p 398 N86-30305 #

AD-A165889 p 404 N86-30330 #

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AD-A166074 p 405 N86-31216 #

AD-A166097 p 404 N86-30331 #

AD-A166205 p 404 N86-30332 #

AD-A166222 p 404 N86-30333 #

AD-A166263 p 405 N86-30334 #

AD-A166292 p 398 N86-30306 #

AD-A166521 p 402 N86-31211 #

AD-A166522 p 402 N86-31212 #

AD-A166523 p 402 N86-31213 #

AD-A166729 p 398 N86-30307 #

AD-A166887 p 393 N86-31207 #

AD-A166913 p 402 N86-31214 #

AD-A166949 p 409 N86-31221 #

AD-A166986 p 394 N86-31208 #

AD-A166998 p 394 N86-31209 #

AD-A167291 p 405 N86-31217 #

AD-E900544 p 402 N86-31211 #

AD-E900544 p 402 N86-31212 #

AD-E900544 p 402 N86-31213 #

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AFOSR-86-0109TR p 404 N86-30331 #

AFOSR-86-0110TR p 404 N86-30332 #

AFOSR-86-0226TR p 394 N86-31209 #

AGARD-CP-396 p 398 N86-30309 #

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AIAA PAPER 86-2316 p 407 A86-46944 #

AIAA PAPER 86-2317 p 407 A86-46945 * #

AIAA PAPER 86-2346 p 393 A86-46960 #

ARI-RN-86-30 p 405 N86-31217 #

CONF-8504206-1 p 398 N86-30308 #

CONF-860210-3 p 402 N86-31215 #

CONF-860415-2 p 408 N86-30340 #

CONF-860470-1 p 409 N86-31222 #

DE85-016121 p 411 N86-30346 #

DE86-003453 p 409 N86-31222 #

DE86-004041 p 398 N86-30308 #

DE86-005160 p 408 N86-30340 #

DE86-005362 p 411 N86-30344 #

DE86-005363 p 411 N86-30345 #

DE86-005807 p 411 N86-30347 #

DE86-007734 p 402 N86-31215 #

DE86-008181 p 409 N86-31223 #

DE86-008182 p 409 N86-31224 #

DE86-008183 p 409 N86-31225 #

DE86-008184 p 409 N86-31226 #

DE86-901038 p 412 N86-30348 #

DOE/RA-50219/T5 p 411 N86-30346 #

DOE/RA-50219/T8 p 411 N86-30347 #

EGG-SSDC-31 p 409 N86-31225 #

EPRI-EA-4318-VOL-5 p 411 N86-30344 #

EPRI-EA-4318-VOL-6 p 411 N86-30345 #

ESA-86-97242 p 408 N86-30341 #

ESA-86-97398 p 405 N86-30335 #

ESA-86-97399 p 405 N86-30336 #

ESA-86-97400 p 405 N86-30337 #

FOA-C-50038-H1 p 408 N86-30341 #

INER-0575 p 412 N86-30348 #

IPO-19-1984 p 405 N86-30335 #

ISBN-92-835-0385-6 p 398 N86-30309 #

ISSN-0347-7665 p 408 N86-30341 #

IZF-1986-2 p 405 N86-30336 #

IZF-1986-4 p 405 N86-30337 #

NADC-85115-60 p 404 N86-30329 #

NAS 1.15:88775 p 404 N86-30328 * #

NAS 1.15:89188 p 393 N86-30302 * #

NAS 1.15:89228 p 397 N86-30303 * #

NAS 1.26:171926 p 408 N86-30339 * #

NAS 1.26:176938 p 408 N86-30338 * #

NAS 1.26:176986 p 408 N86-31218 * #

NAS 1.26:177029 p 411 N86-30343 * #

NAS 1.26:177106 p 410 N86-30342 * #

NASA-CR-171926 p 408 N86-30339 * #

NASA-CR-176938 p 408 N86-30338 * #

NASA-CR-176986 p 408 N86-31218 * #

NASA-CR-177029 p 411 N86-30343 * #

NASA-CR-177106 p 410 N86-30342 * #

NASA-TM-86775 p 404 N86-30328 * #

NASA-TM-89188 p 393 N86-30302 * #

NASA-TM-89228 p 397 N86-30303 * #

NATICK-TR-86/019 p 409 N86-31221 #

NRL-MR-5744 p 393 N86-31207 #

NSMRL-1037 p 398 N86-30306 #

NSMRL-1069-2 p 405 N86-30334 #

OEHL-86-020C0111BRA p 402 N86-31214 #

PNL-SA-13716 p 402 N86-31215 #

SSDC-30 p 409 N86-31226 #

SSDC-32 p 409 N86-31224 #

SSDC-34 p 409 N86-31223 #

TDCK-86-0580 p 405 N86-30336 #

TDCK-86-0585 p 405 N86-30337 #

TR-21 p 394 N86-31208 #

USARIEM-M-19/86 p 398 N86-30305 #

USARIEM-M-20/86 p 402 N86-31211 #

USARIEM-M-21/86 p 402 N86-31213 #

USARIEM-M-22/86 p 402 N86-31212 #

USARIEM-M-23/86 p 398 N86-30307 #

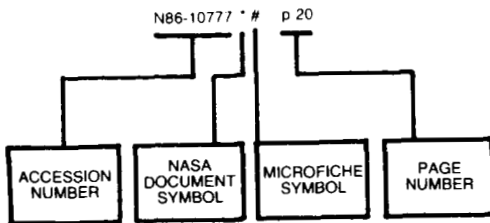
REPORT

ACCESSION NUMBER INDEX

AEROSPACE MEDICINE AND BIOLOGY / A Continuing Bibliography (Supplement 291)

December 1986

Typical Accession Number Index Listing



Listings in this index are arranged alpha-numerically by accession number. The page number listed to the right indicates the page on which the citation is located. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

N86-31212 # p 402
 N86-31213 # p 402
 N86-31214 # p 402
 N86-31215 # p 402
 N86-31216 # p 405
 N86-31217 # p 405
 N86-31218 * # p 408
 N86-31219 * # p 408
 N86-31220 * # p 408
 N86-31221 # p 409
 N86-31222 # p 409
 N86-31223 # p 409
 N86-31224 # p 409
 N86-31225 # p 409
 N86-31226 # p 409
 N86-31412 * # p 409
 N86-31421 * # p 412
 N86-31422 * # p 410
 N86-31426 * # p 402
 N86-31428 * # p 403
 N86-31431 * # p 412
 N86-31436 * # p 412

A86-43535 #	p 403	A86-46945 * #	p 407
A86-43539 #	p 403	A86-46960 #	p 393
A86-43540 #	p 391		
A86-43676 #	p 391	N86-30302 * #	p 393
A86-43677 #	p 391	N86-30303 * #	p 397
A86-43750 #	p 394	N86-30304 #	p 397
A86-43927 #	p 410	N86-30305 #	p 398
A86-44087 #	p 394	N86-30306 #	p 398
A86-44088 #	p 395	N86-30307 #	p 398
A86-44089 #	p 395	N86-30308 #	p 398
A86-44090 #	p 395	N86-30309 #	p 398
A86-44091 #	p 395	N86-30310 #	p 398
A86-44092 #	p 395	N86-30311 #	p 399
A86-44093 #	p 395	N86-30312 #	p 399
A86-44094 #	p 405	N86-30313 #	p 399
A86-44095 #	p 395	N86-30314 #	p 399
A86-44096 #	p 396	N86-30315 #	p 399
A86-44097 #	p 396	N86-30316 #	p 399
A86-44194 #	p 396	N86-30317 #	p 400
A86-44195 #	p 391	N86-30318 #	p 400
A86-44196 * #	p 391	N86-30319 #	p 400
A86-44197 #	p 391	N86-30320 #	p 400
A86-44295 #	p 392	N86-30321 #	p 400
A86-44354 * #	p 410	N86-30322 #	p 400
A86-44358 #	p 410	N86-30323 #	p 401
A86-44532 #	p 406	N86-30324 #	p 401
A86-44534 #	p 406	N86-30325 #	p 401
A86-44601 #	p 403	N86-30326 #	p 401
A86-44778 #	p 396	N86-30327 #	p 401
A86-44779 #	p 406	N86-30328 * #	p 404
A86-44780 #	p 396	N86-30329 #	p 404
A86-44814 #	p 396	N86-30330 #	p 404
A86-45014 #	p 406	N86-30331 #	p 404
A86-45015 #	p 406	N86-30332 #	p 404
A86-45073 #	p 406	N86-30333 #	p 404
A86-45117 #	p 407	N86-30334 #	p 405
A86-45251 * #	p 392	N86-30335 #	p 405
A86-45254 * #	p 397	N86-30336 #	p 405
A86-45318 #	p 392	N86-30337 #	p 405
A86-45319 #	p 392	N86-30338 * #	p 408
A86-45320 #	p 392	N86-30339 * #	p 408
A86-45321 #	p 392	N86-30340 #	p 408
A86-45322 #	p 392	N86-30341 #	p 408
A86-45323 #	p 393	N86-30342 * #	p 410
A86-45324 #	p 393	N86-30343 * #	p 411
A86-45325 #	p 397	N86-30344 #	p 411
A86-45692 * #	p 407	N86-30345 #	p 411
A86-45955 #	p 403	N86-30346 #	p 411
A86-45960 * #	p 393	N86-30347 #	p 411
A86-46270 #	p 397	N86-30348 #	p 412
A86-46938 #	p 397	N86-31207 #	p 393
A86-46941 #	p 407	N86-31208 #	p 394
A86-46942 #	p 407	N86-31209 #	p 394
A86-46943 * #	p 407	N86-31210 #	p 401
A86-46944 #	p 407	N86-31211 #	p 402

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1. Report No. NASA SP-7011 (291)		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Aerospace Medicine and Biology A Continuing Bibliography (Suppl. 291)				5. Report Date December 1986	
				6. Performing Organization Code	
7. Author(s)				8. Performing Organization Report No.	
				10. Work Unit No.	
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, DC 20546				11. Contract or Grant No.	
				13. Type of Report and Period Covered	
12. Sponsoring Agency Name and Address				14. Sponsoring Agency Code	
15. Supplementary Notes					
16. Abstract This bibliography lists 131 reports, articles and other documents introduced into the NASA scientific and technical information system in November 1986.					
17. Key Words (Suggested by Author(s)) Aerospace Medicine Bibliographies Biological Effects			18. Distribution Statement Unclassified - Unlimited		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 60	
				22. Price* A04/HC	

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